US006802257B2

(12) **United States Patent**
Tobe et al.

(10) **Patent No.: US 6,802,257 B2**
(45) **Date of Patent: Oct. 12, 2004**

(54) **PLATE INSERTING APPARATUS**

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(73) Assignee: **Komori Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/644,208**

(22) Filed: **Aug. 19, 2003**

(65) **Prior Publication Data**

US 2004/0168600 A1 Sep. 2, 2004

(30) **Foreign Application Priority Data**

Aug. 20, 2002 (JP) 2002/239591

(51) **Int. Cl.**[7] **B41L 47/14**; B65H 9/04

(52) **U.S. Cl.** **101/477**; 101/481; 101/480; 271/248

(58) **Field of Search** ..... 101/477, 479, 101/480, 481, 485, 486, DIG. 36; 271/240, 248, 250, 253

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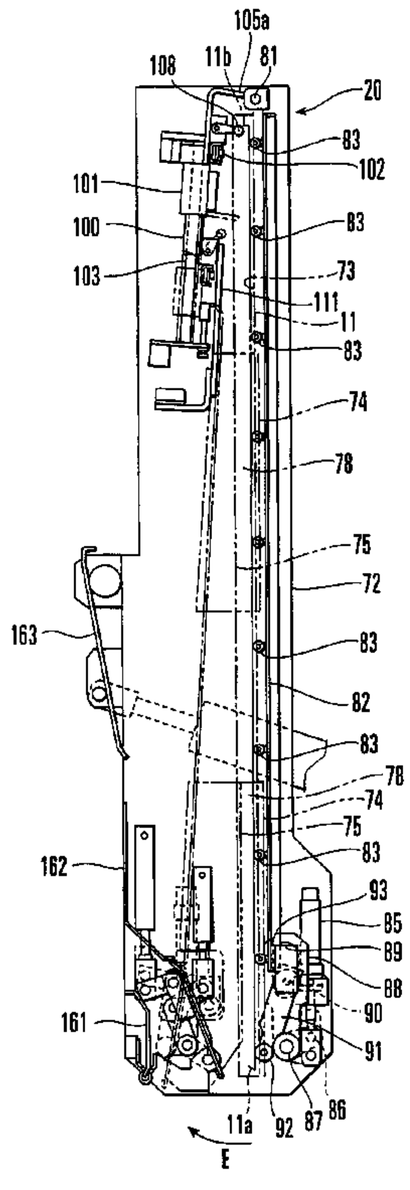
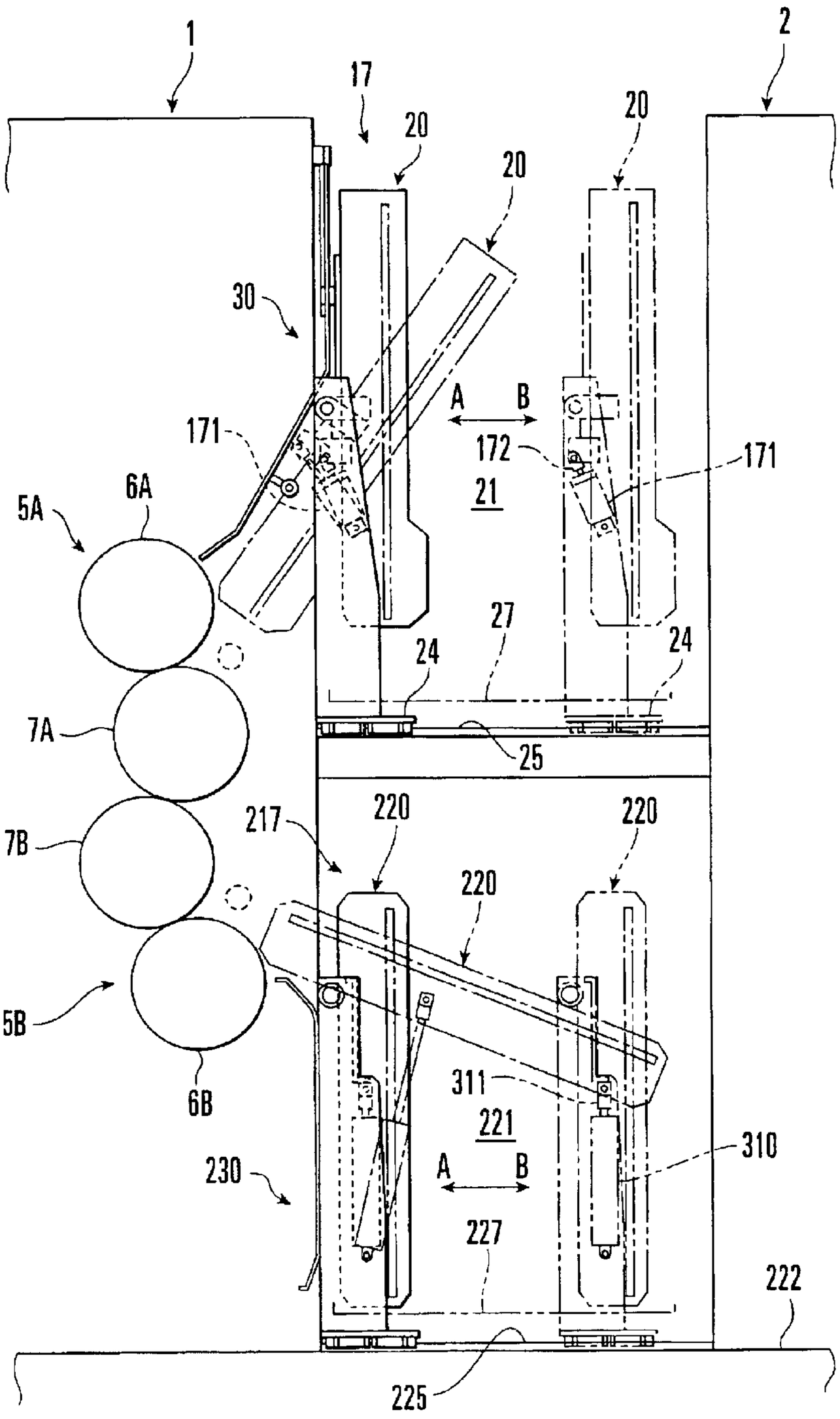
(74) *Attorney, Agent, or Firm*—Blakely Sokoloff Taylor & Zafman

(57) **ABSTRACT**

A plate inserting apparatus includes a loader, a first regulating member, a second regulating member, and support plates, oscillating rollers, air cylinders, a shaft, and bars. The loader holds a new plate inserted in a lateral direction and feeds the new plate to a plate cylinder. The first regulating member regulates a position of one side edge of the new plate inserted in the loader. The second regulating member regulates a position of the other side edge of the new plate inserted in the loader, thus positioning the new plate in a widthwise direction in cooperation with the first regulating member. The support plates, oscillating rollers, air cylinders, shaft, and bars move the new plate inserted in the loader in a direction substantially perpendicular to a plate surface, thus accommodating the new plate between the first and second regulating members.

15 Claims, 22 Drawing Sheets

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B
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172
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21
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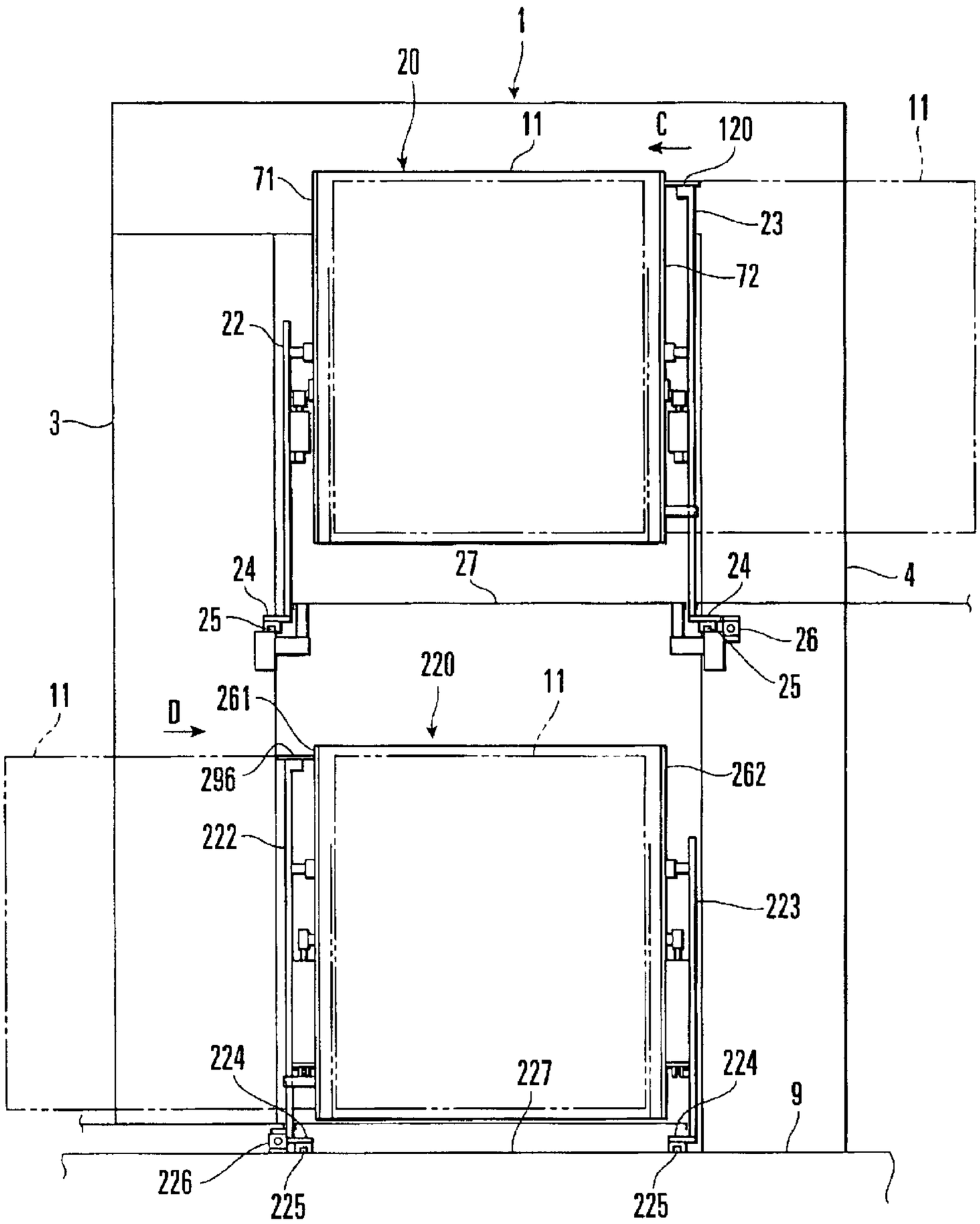
5A
7A
24
27
24
25
7B
217
220
220
220
5B
311
221
310
230
A
B
227
222
6B
225

FIG. 1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72
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3
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4
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11
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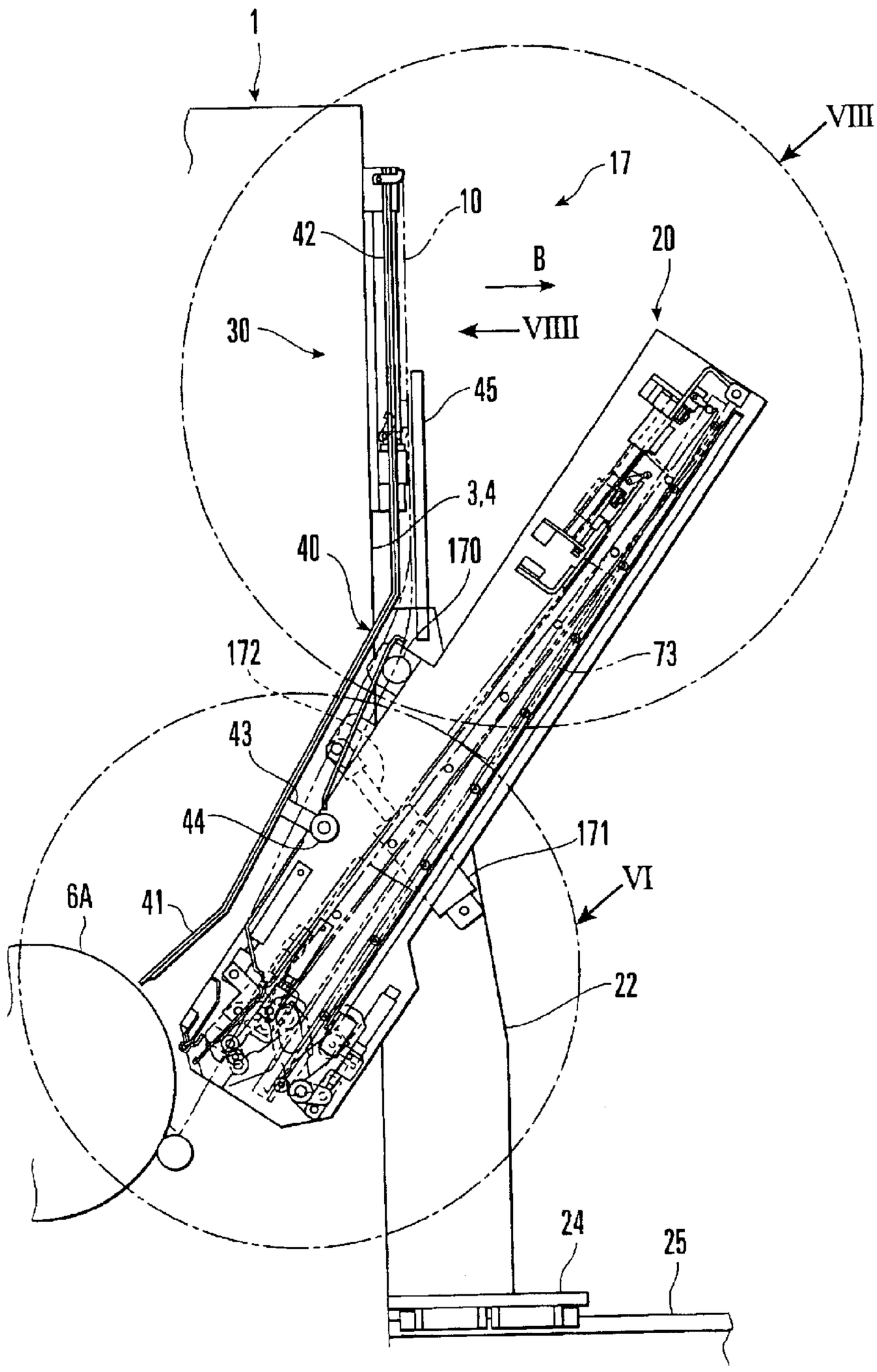
261
11
296
262
222
223
224
227
224
9
226
225
225

FIG. 2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10
42
20
B
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3,4
40
170
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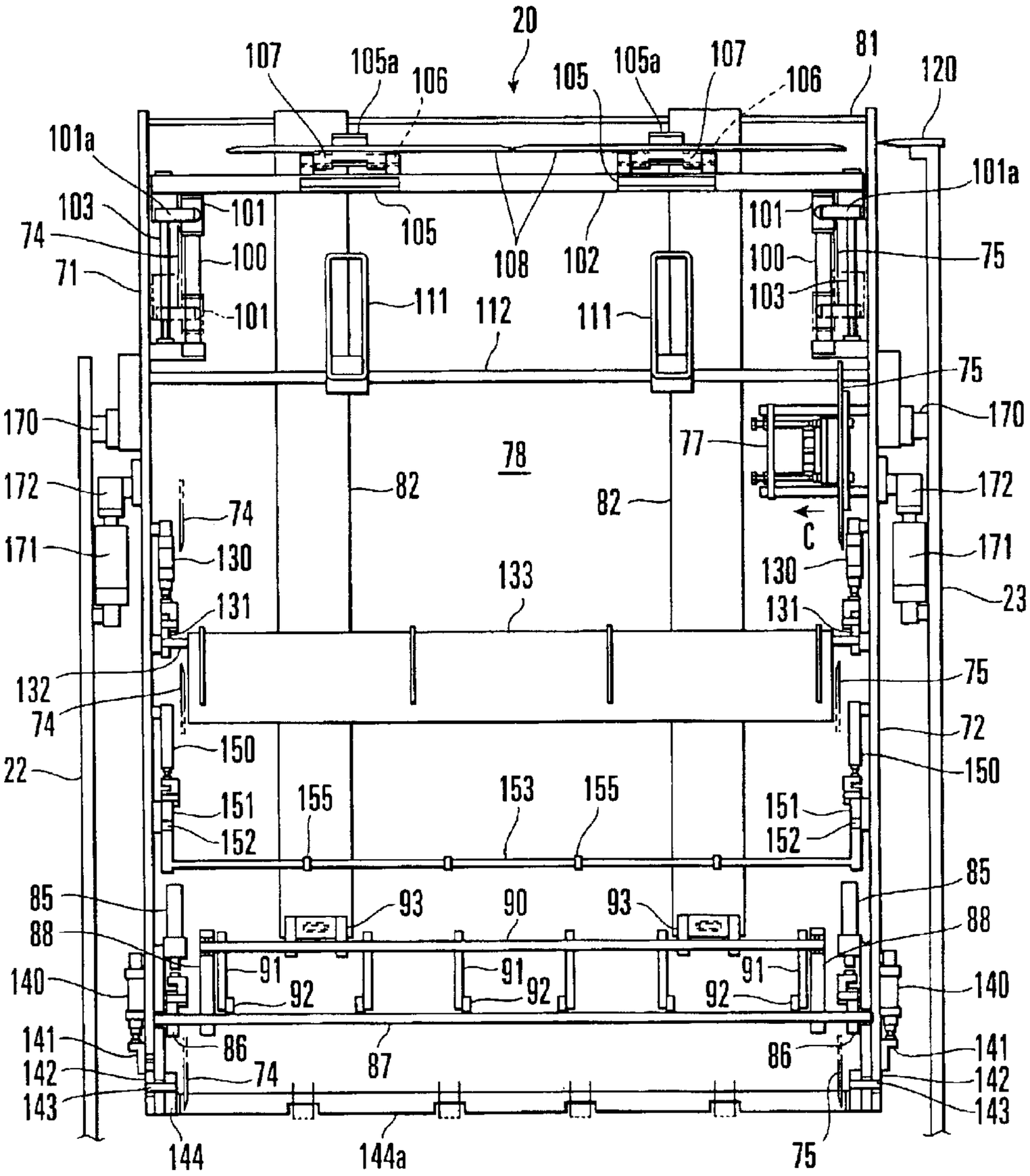
43
44
171
VI
6A
41
22
24
25

FIG. 3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107
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101a
101a
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102
101
100
103
75
111
112
111
75
170
78
77
170
82
82
172
74
C
172
171
130
130
171
133
131
131
23
132
74
75
150
72
22
150
151
155
153
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86
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142
74
142
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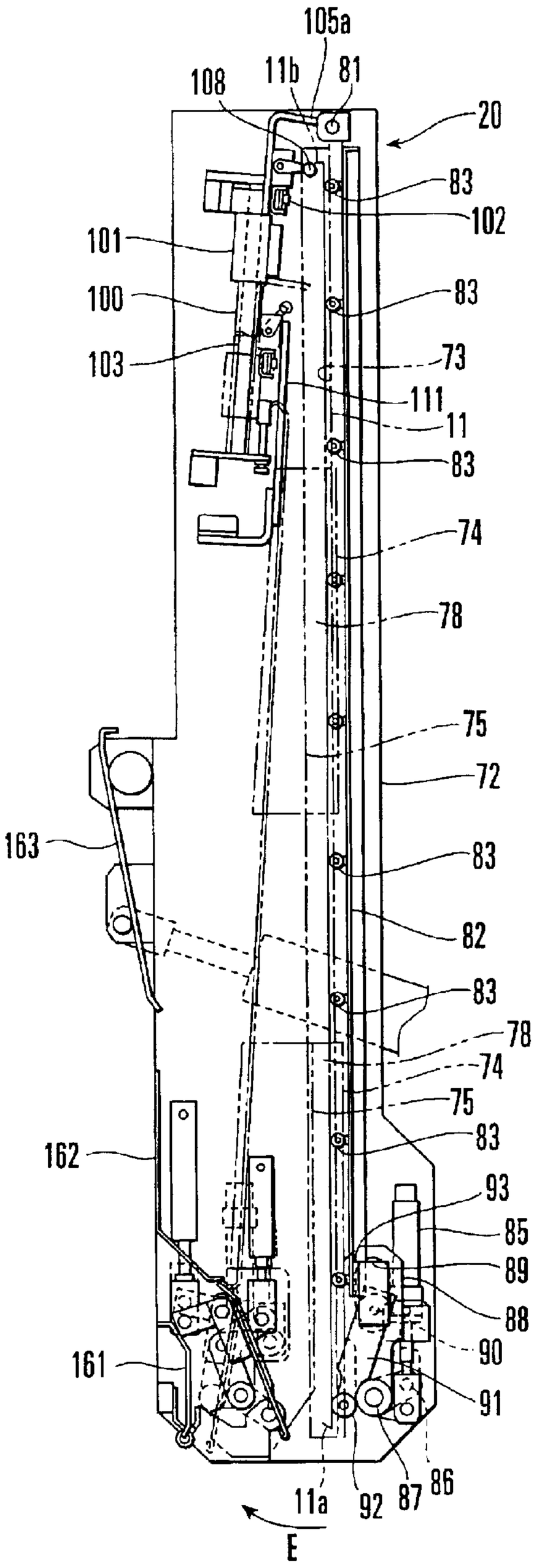
143
144
144a
75

FIG. 4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11b
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111
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83
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163
83
82
83
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162
93
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89
88
90
161
91
86
87
92
11a
E

FIG.5A

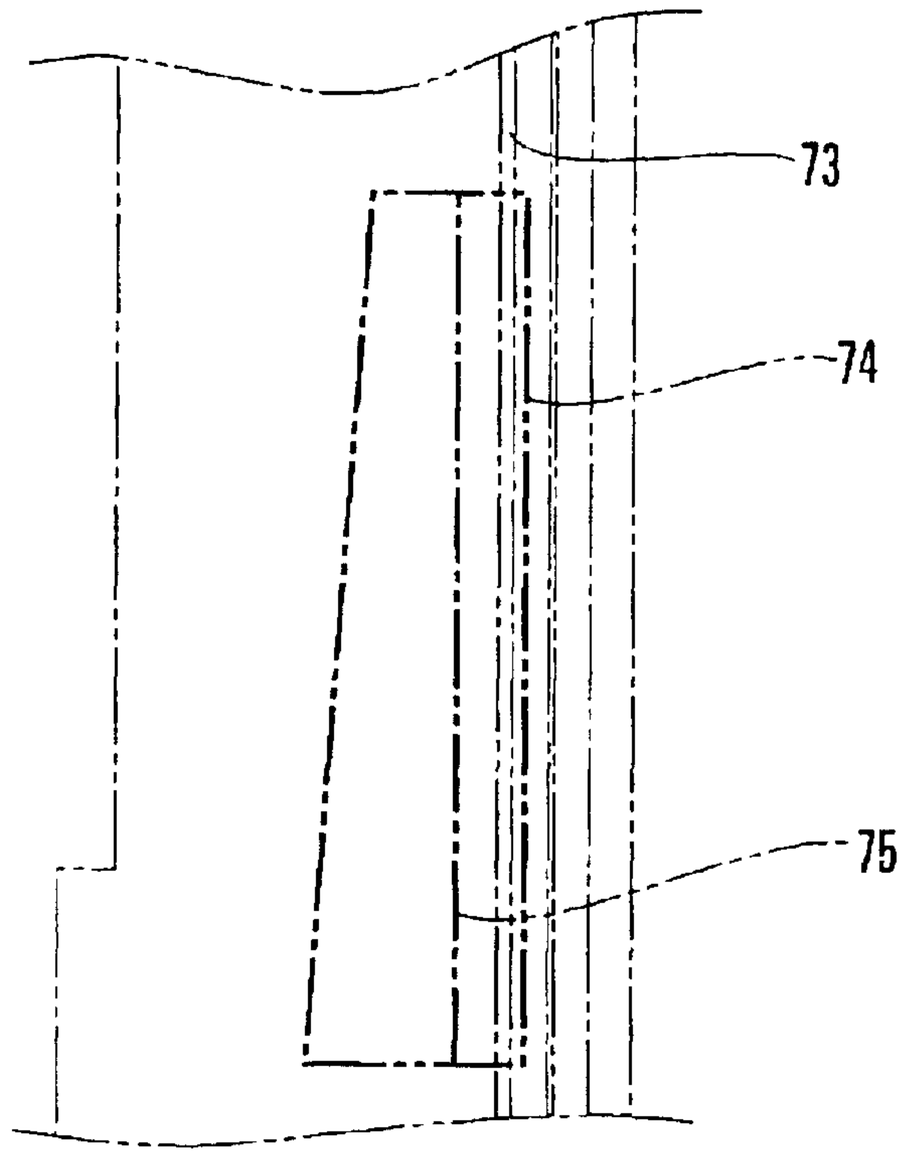


FIG.5B

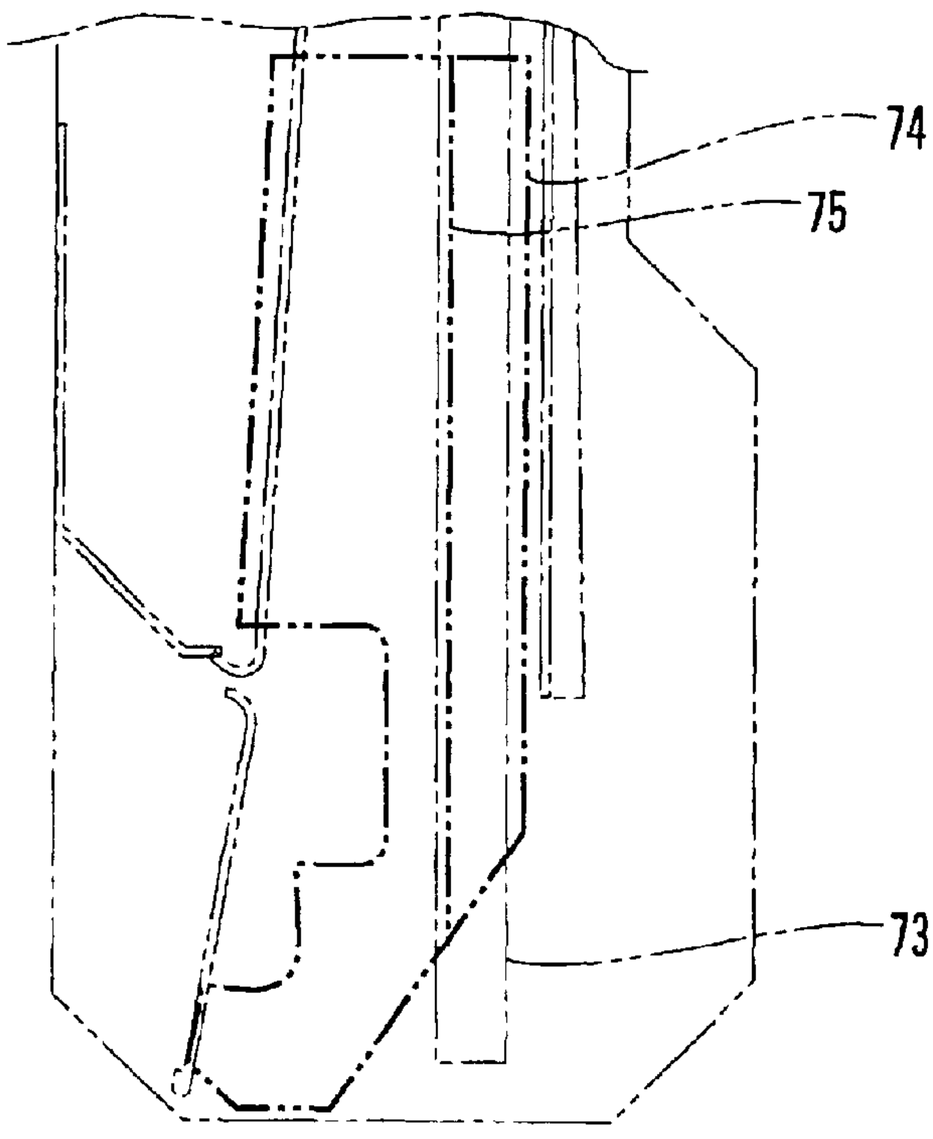
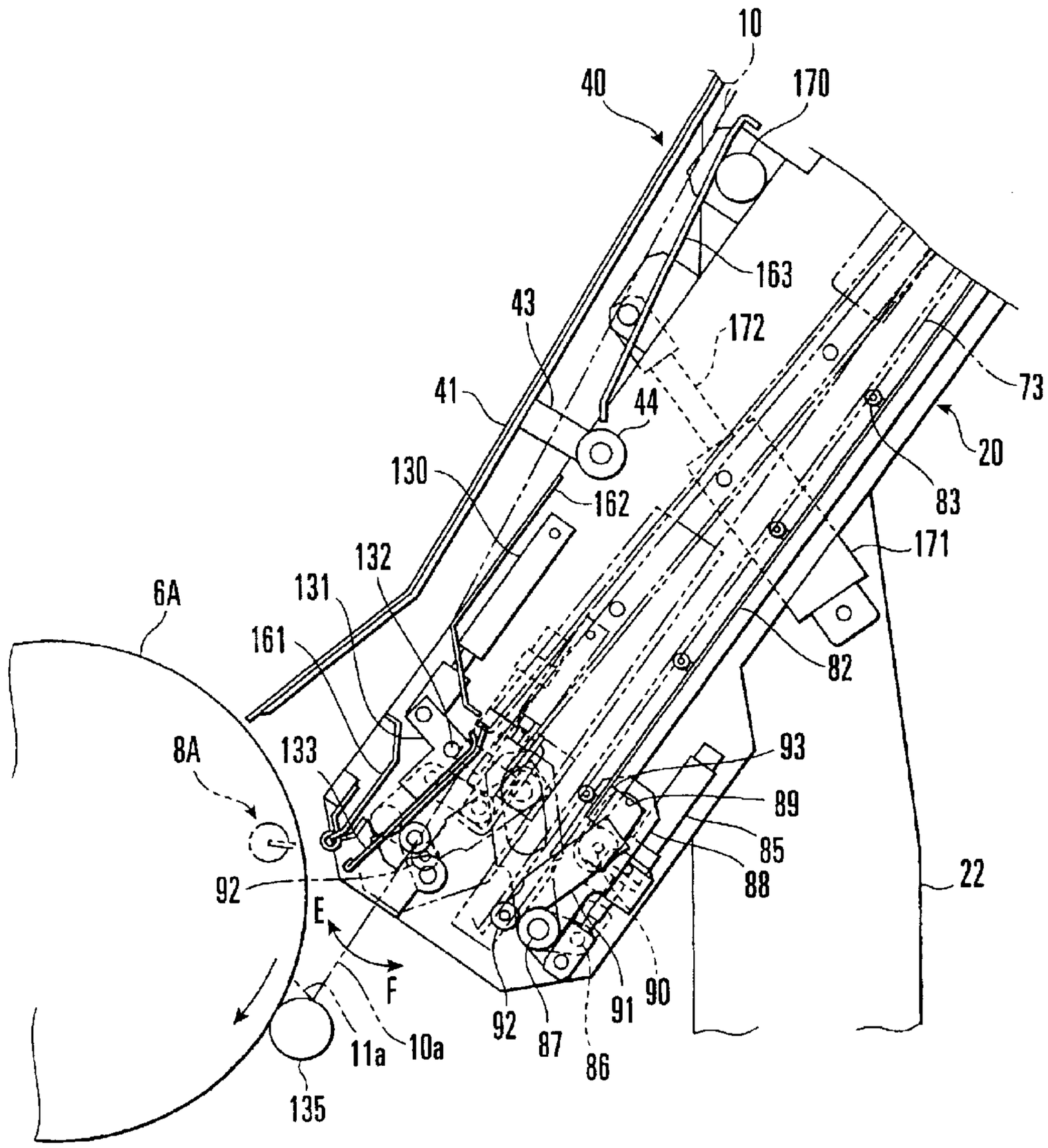


FIG.5C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41
44
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130
162
83
171
132
131
6A
161
82
8A
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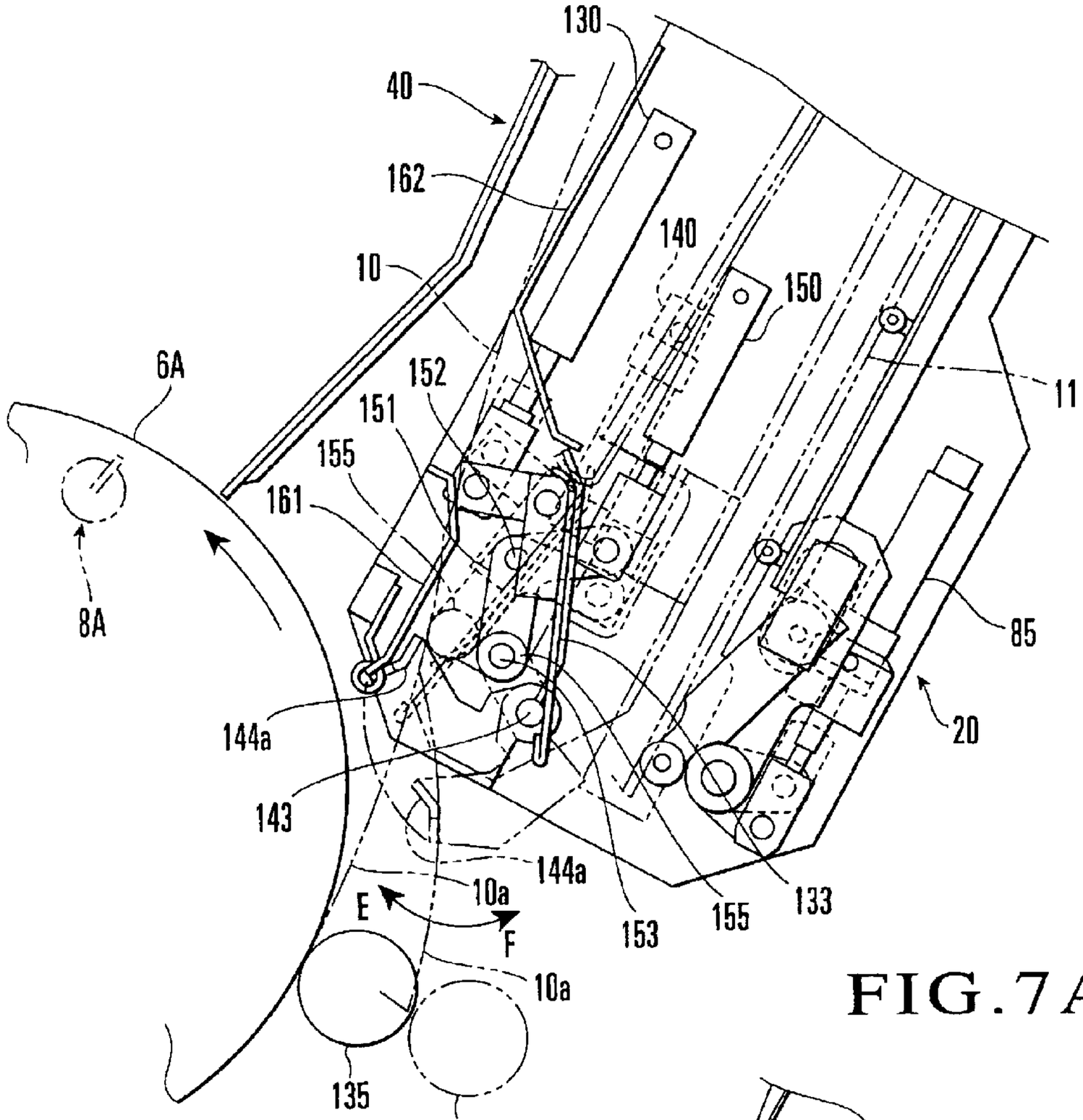
88
92
22
E
F
92
87
91
90
11a
10a
86
135

FIG. 6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6A
152
151
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161
8A
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144a
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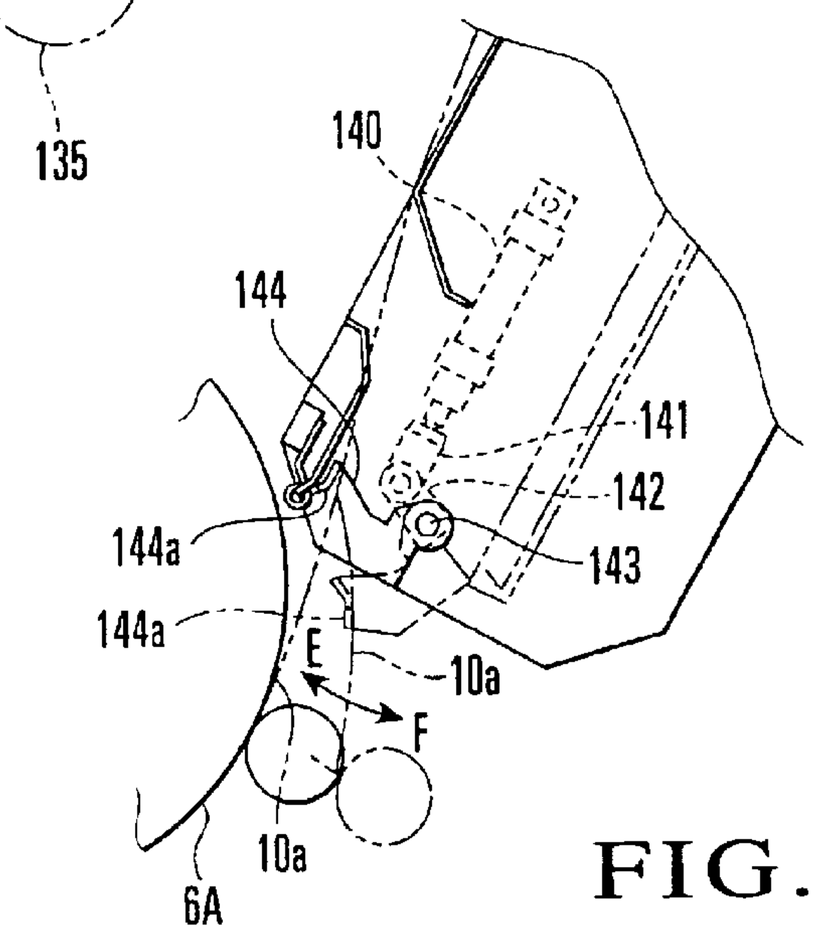
144a
10a
E
F
153
155
133
10a
135

FIG.7A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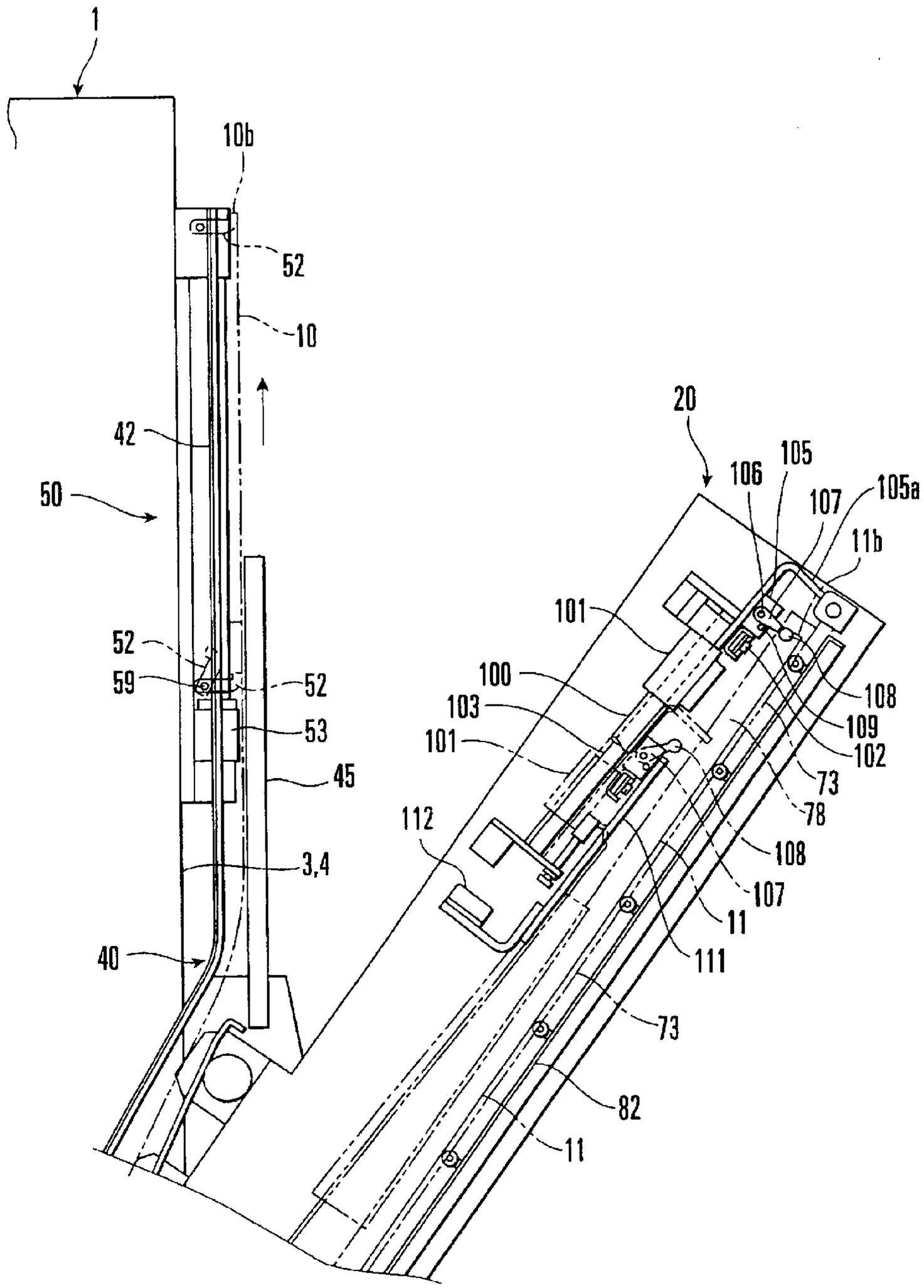
144a
143
144a
E
10a
F
10a
6A

FIG.7B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105a
11b
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102
73
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82
11

FIG. 8

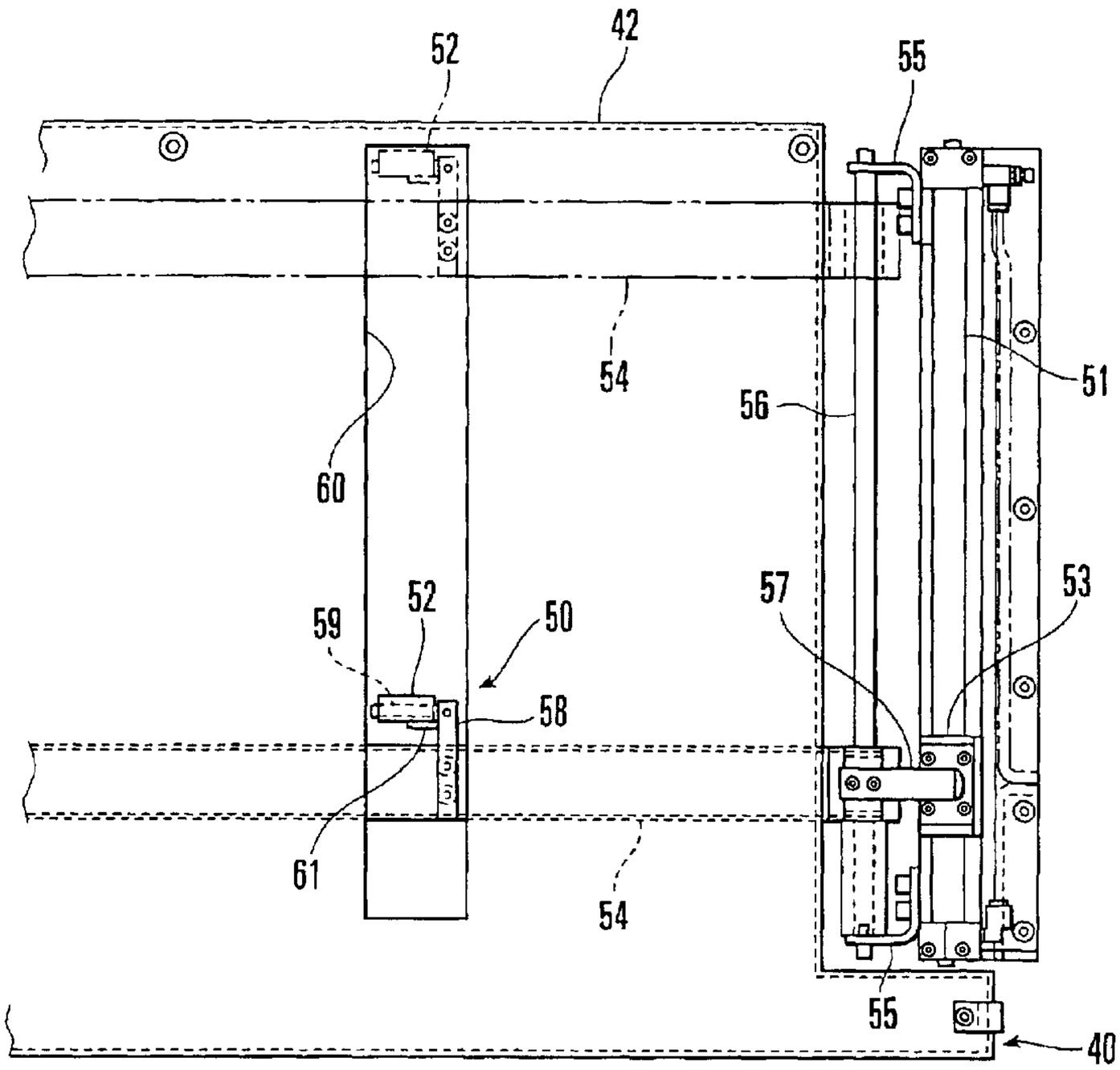


FIG. 9

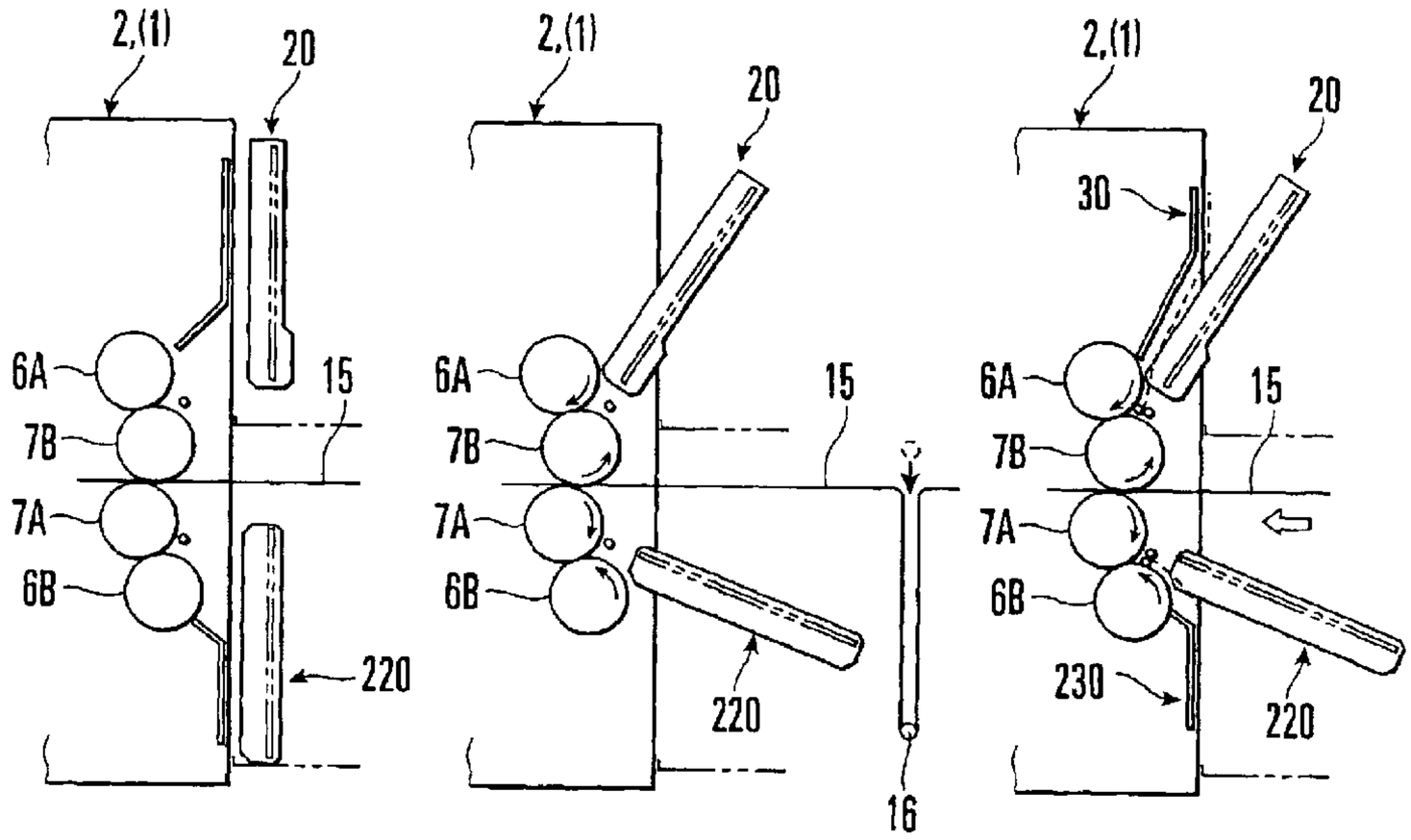


FIG.10A FIG.10B FIG.10C

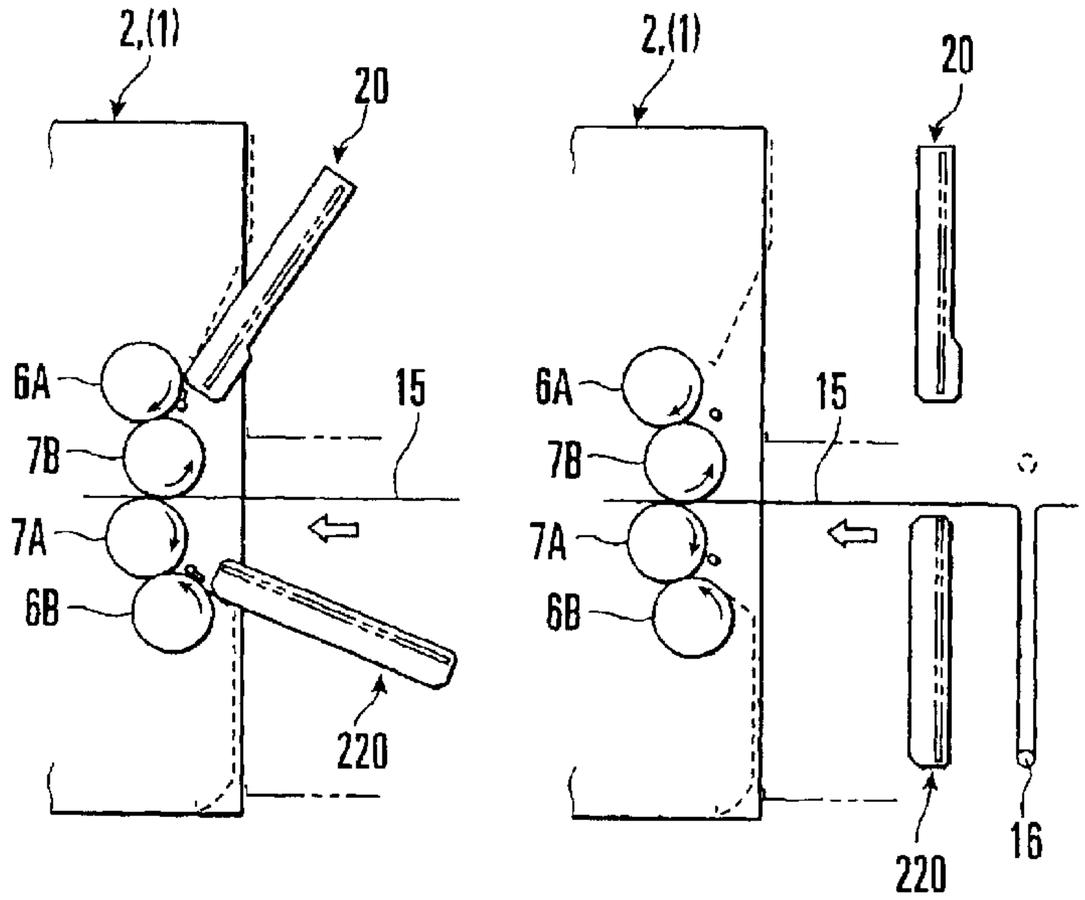
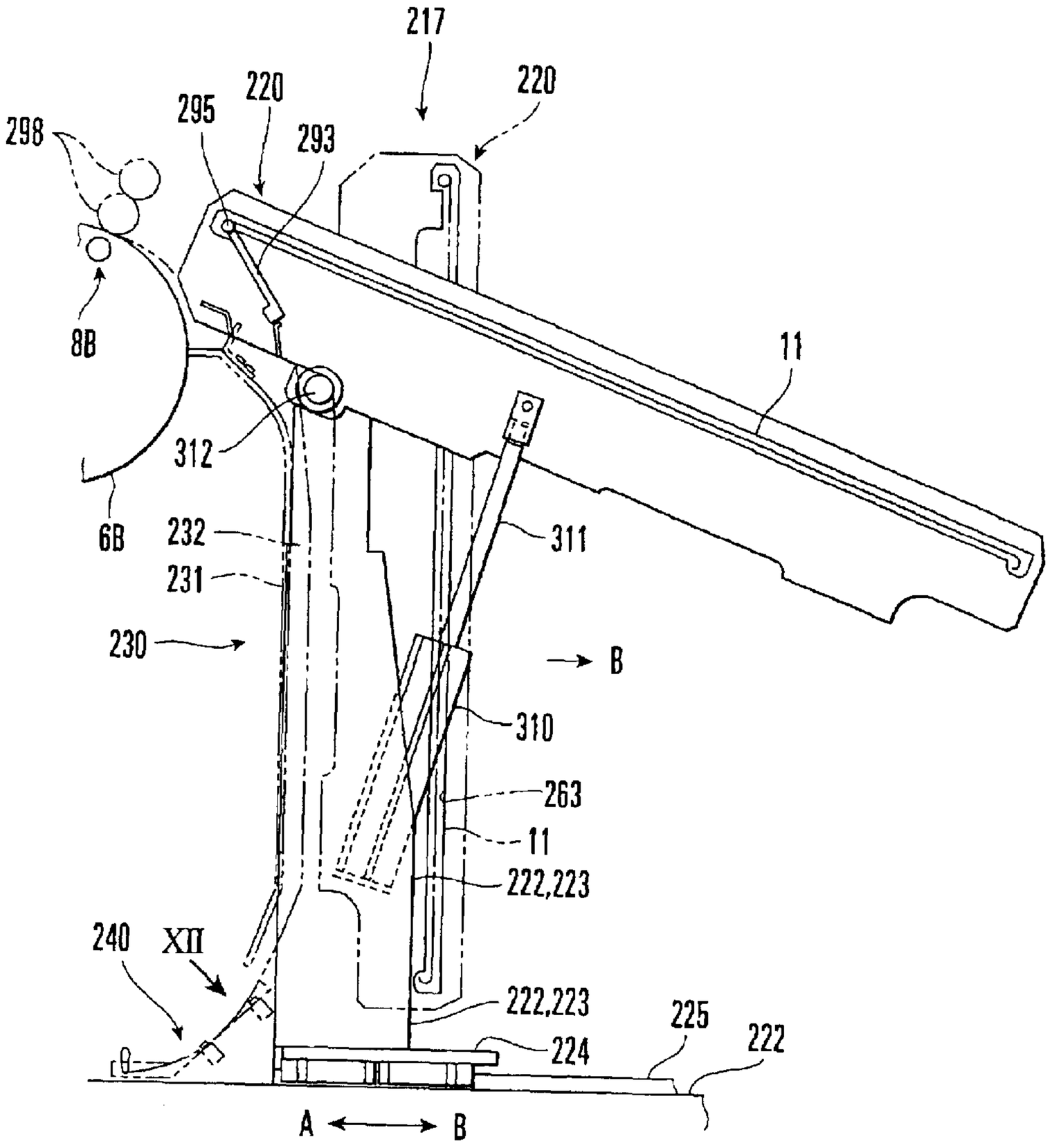


FIG.10D FIG.10E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293
298
8B
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312
6B
232
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B
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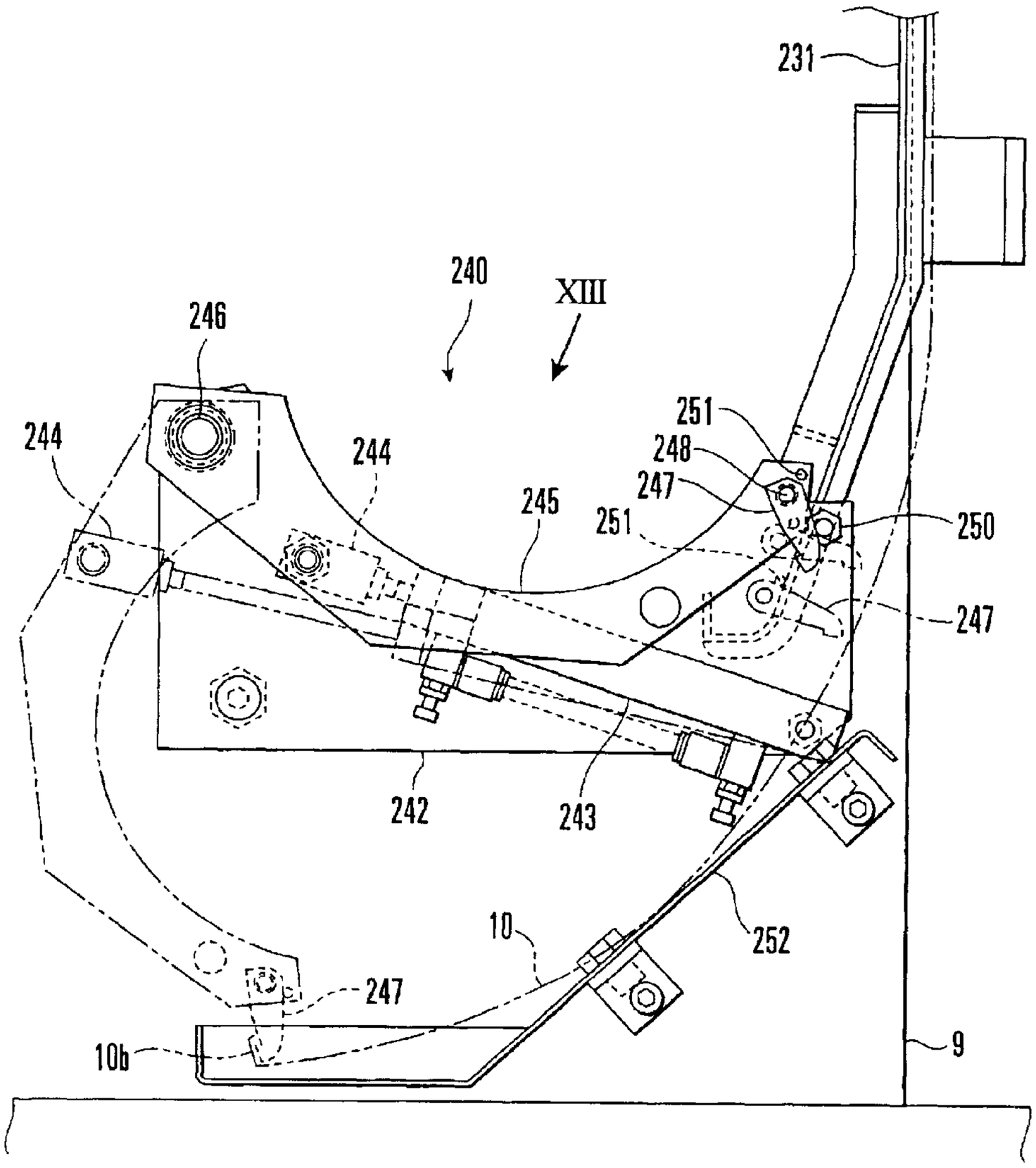
263
11
222,223
240
XII
222,223
225
222
224
θ
A
B

FIG. 11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243
10
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247
10b
9

FIG. 12

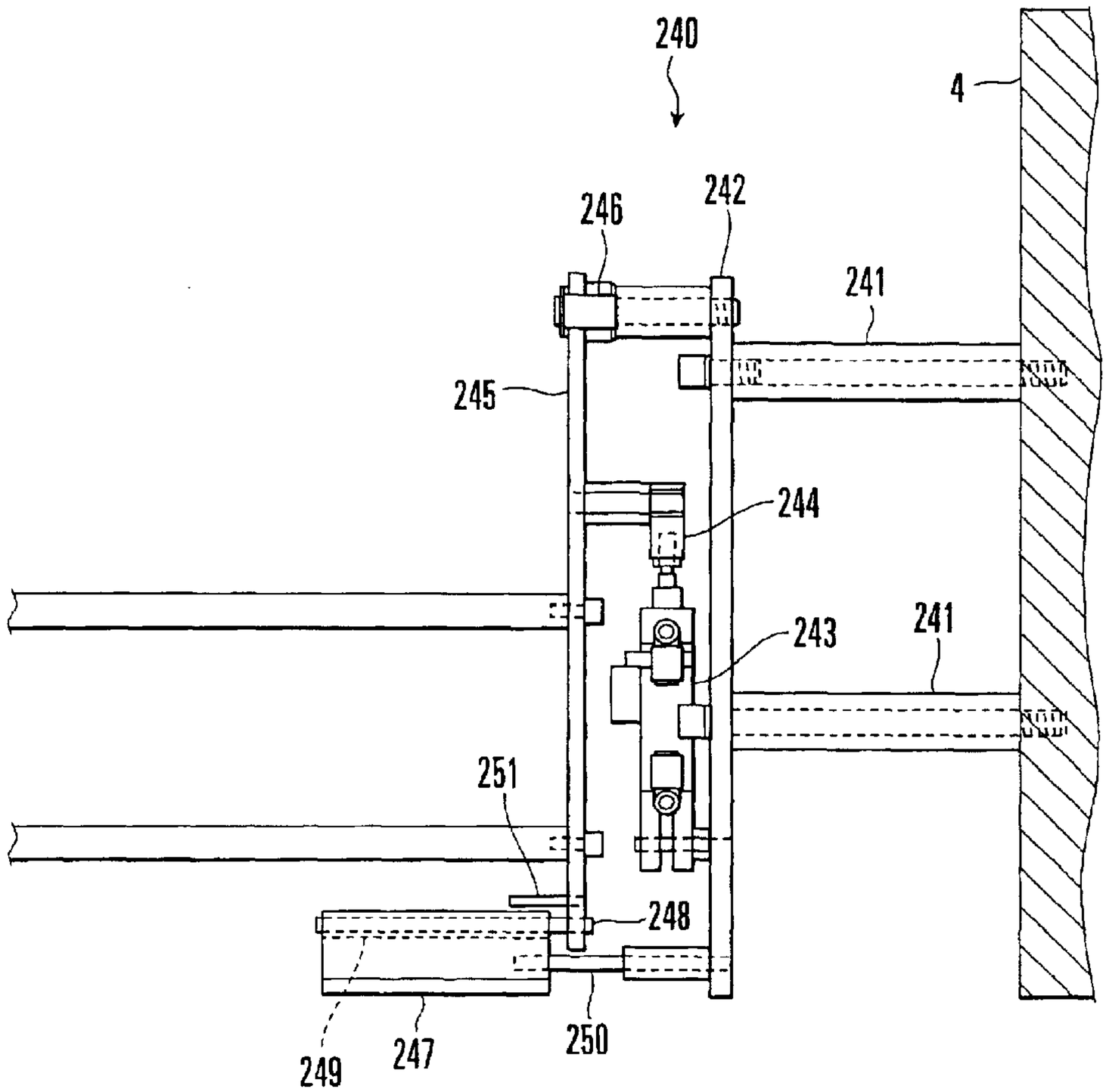
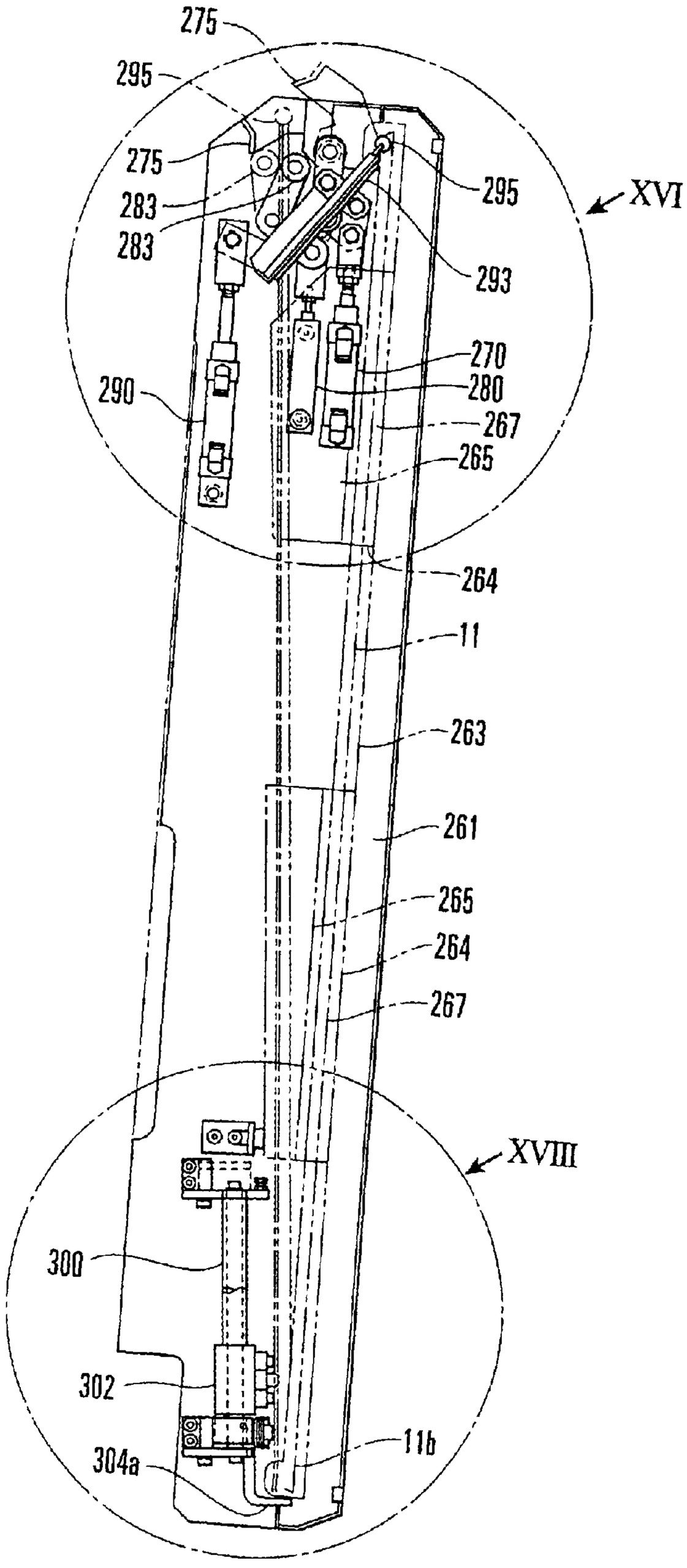


FIG. 13


275
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XVI
293
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280
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264
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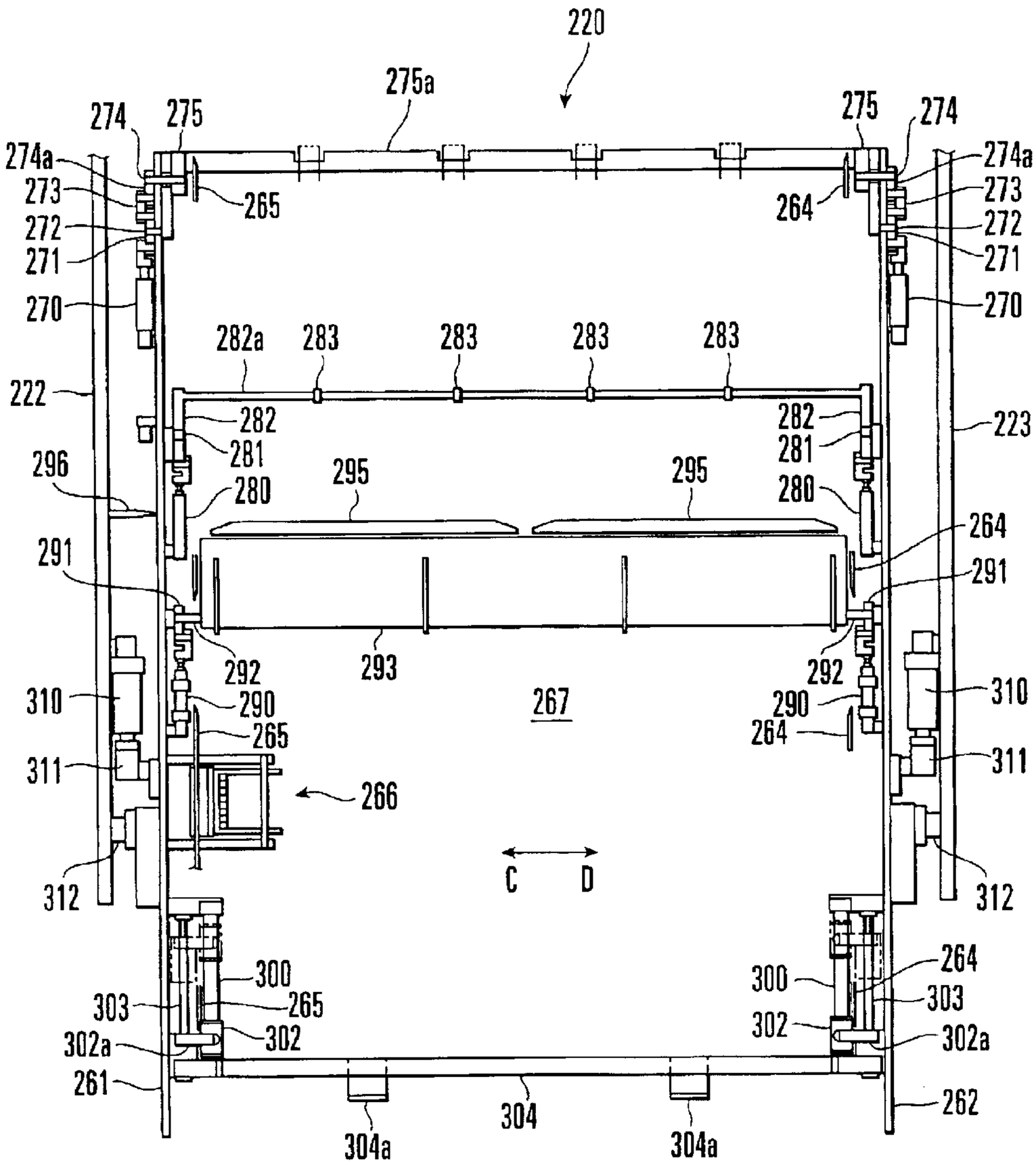
263
261
265
264
267
XVIII
300
302
304a
11b

FIG. 14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282
281
280
223
291
264
291
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293
292
310
290
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290
264
310
311
266
311
C
D
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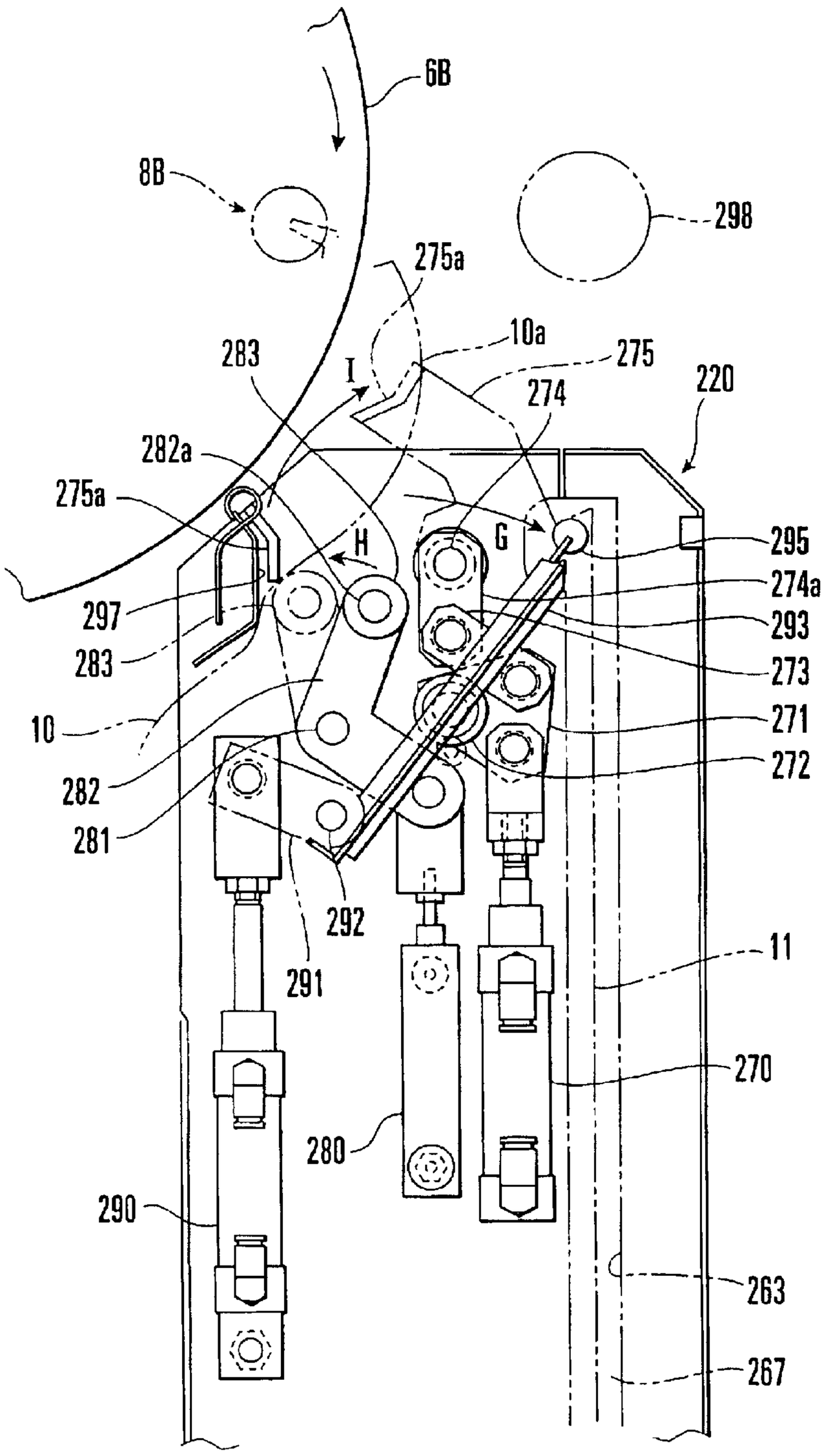
302
302a
261
262
304
304a
304a

FIG. 15


6B
8B
298
275a
10a
283
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G
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273
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11
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290
263
267

FIG. 16

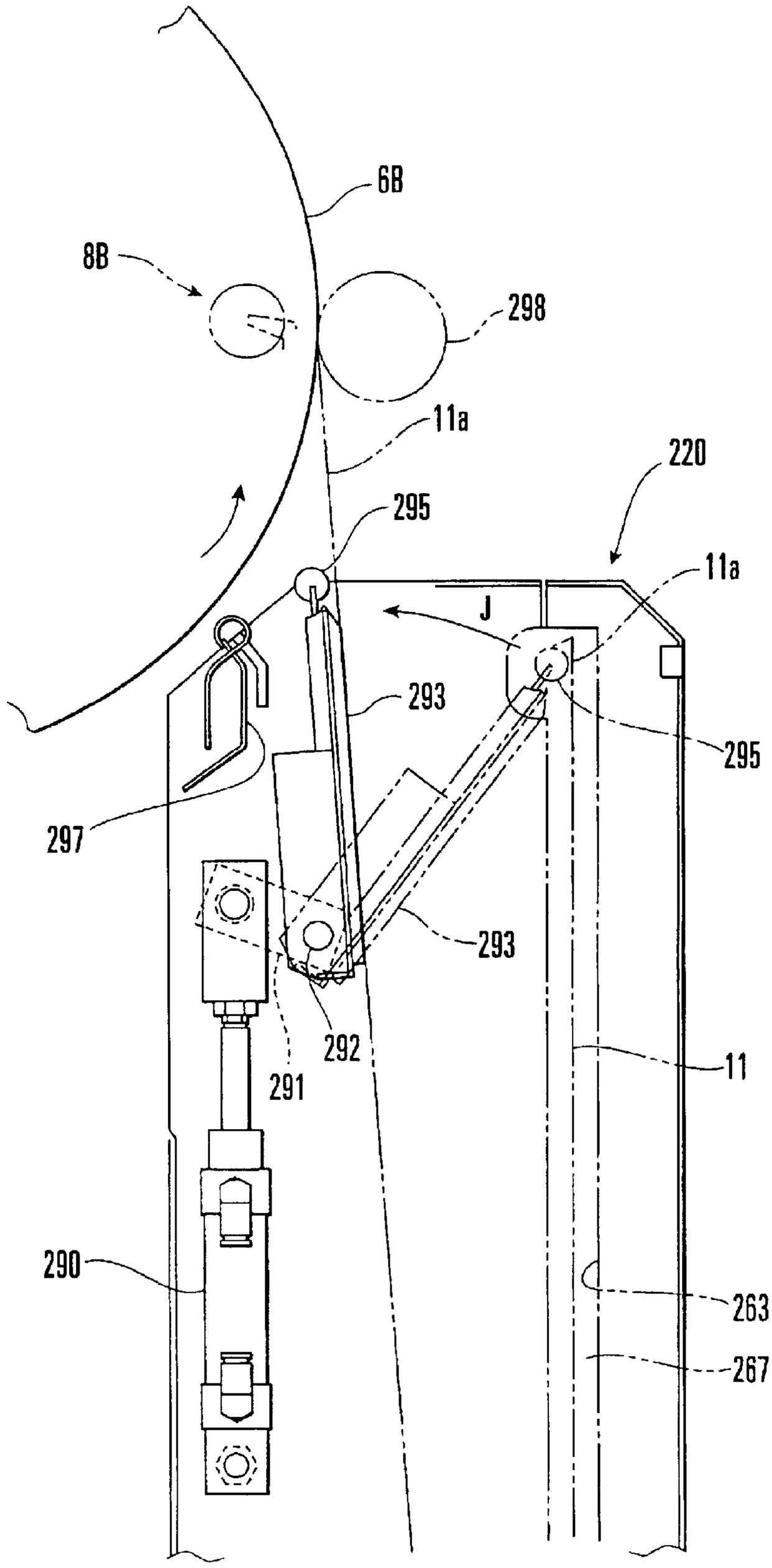

FIG. 17

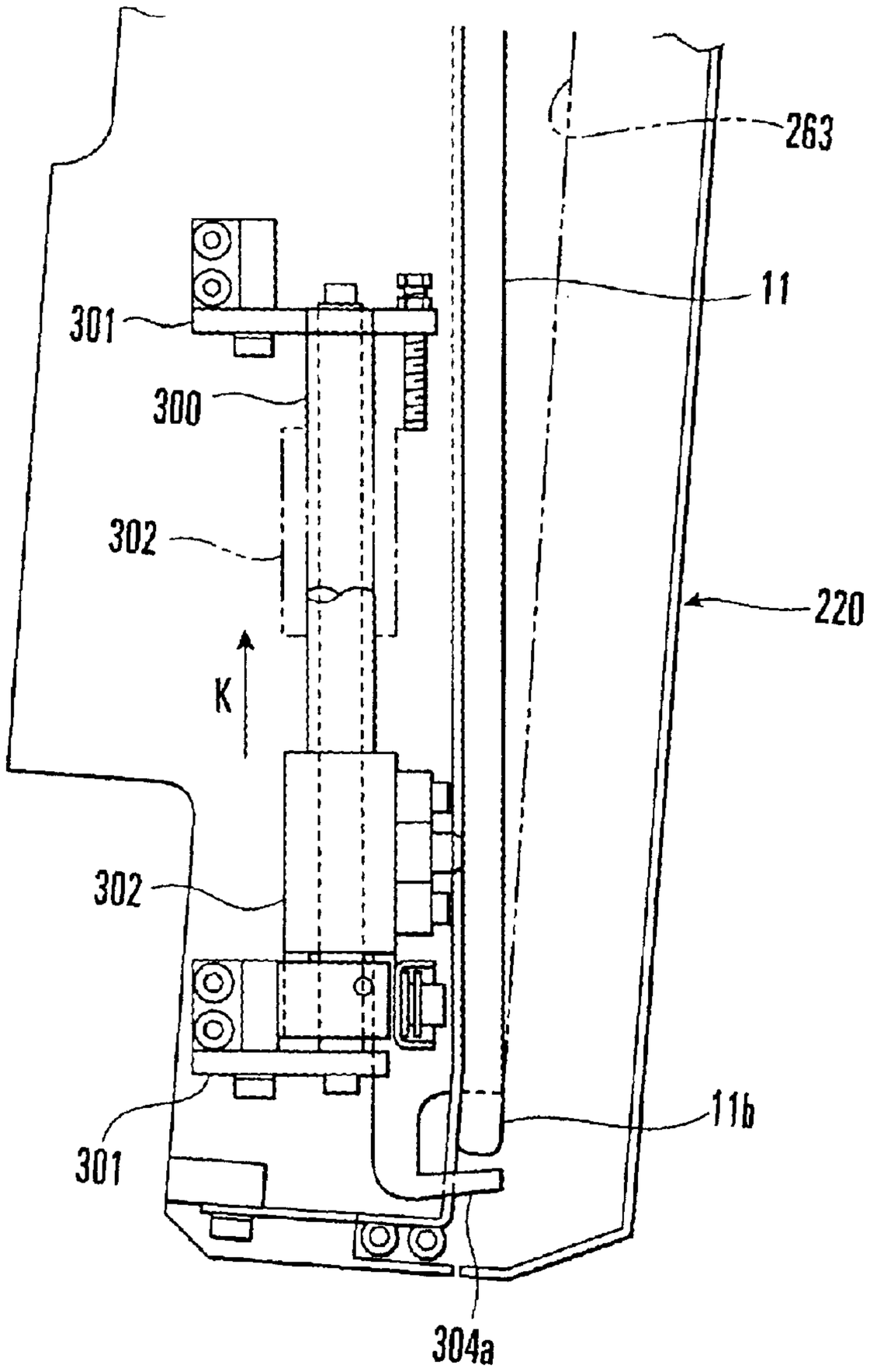

FIG. 18

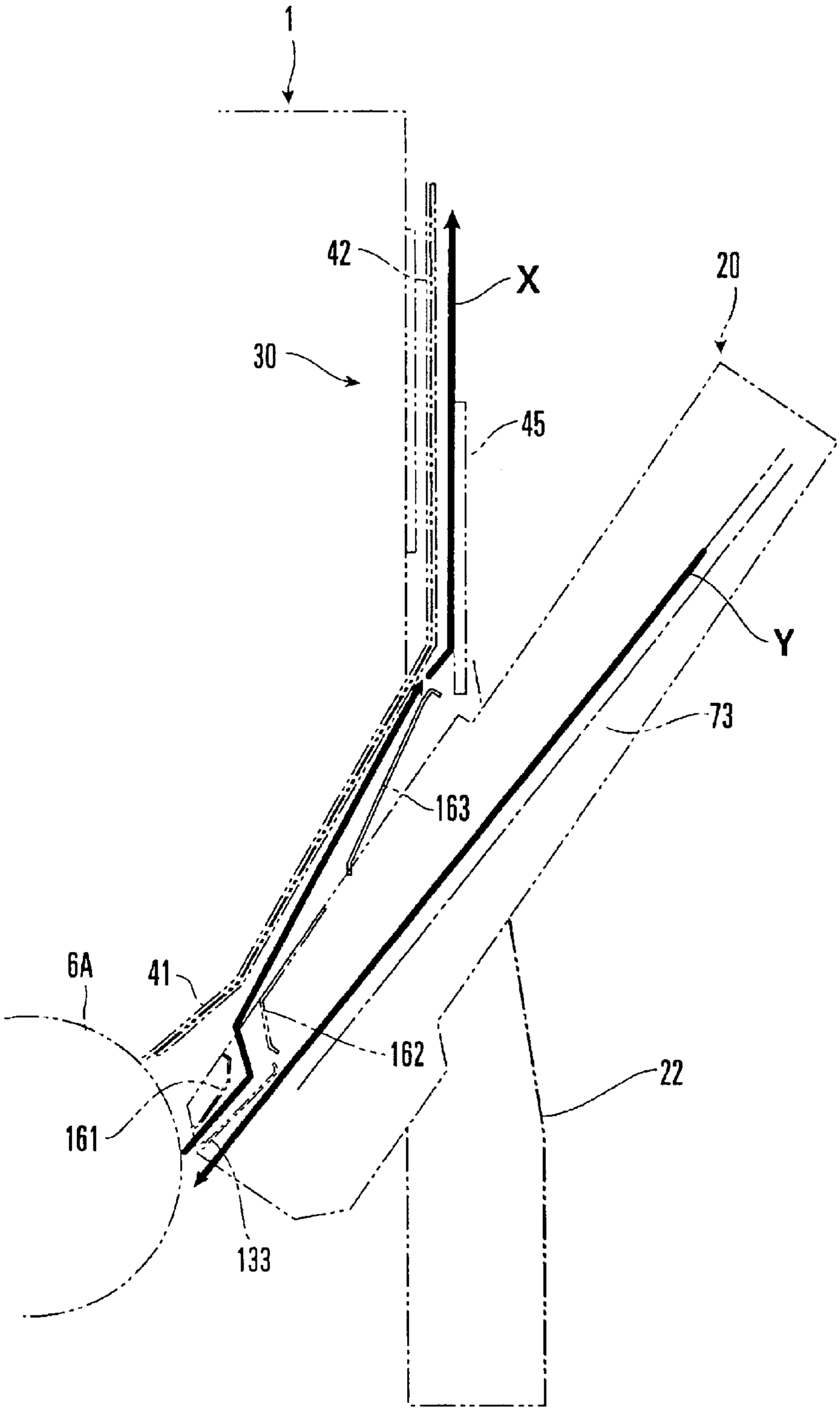

FIG. 19

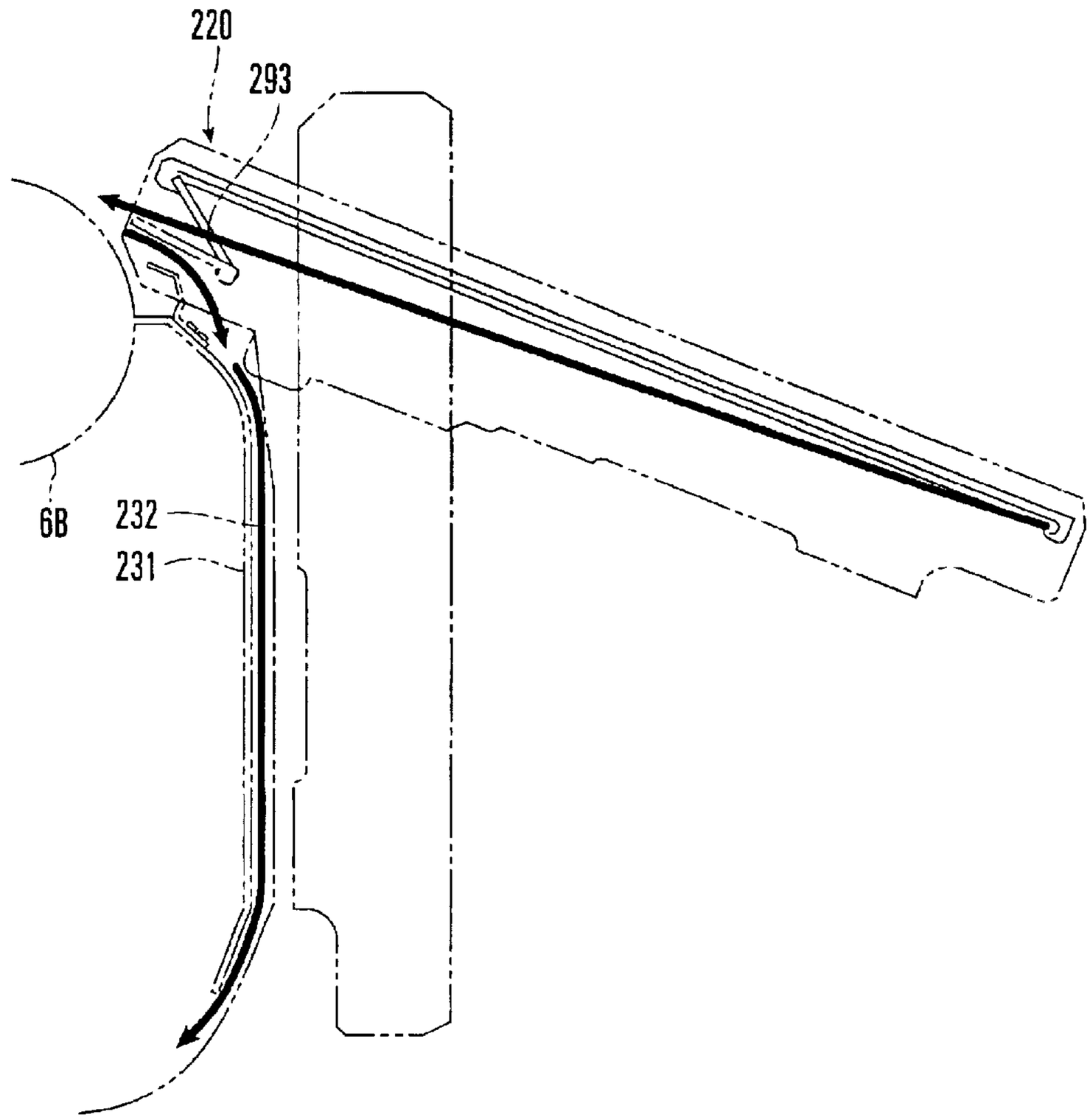

FIG.20

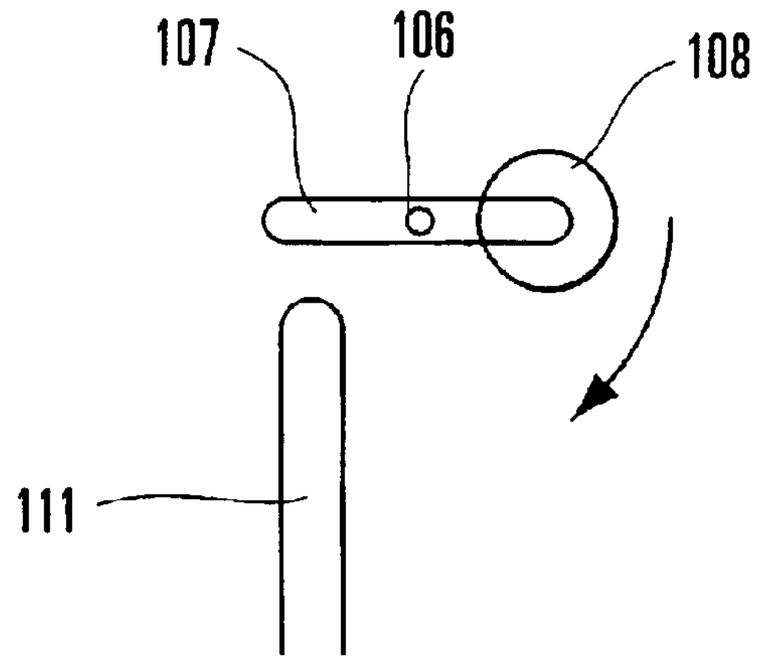

FIG.21A

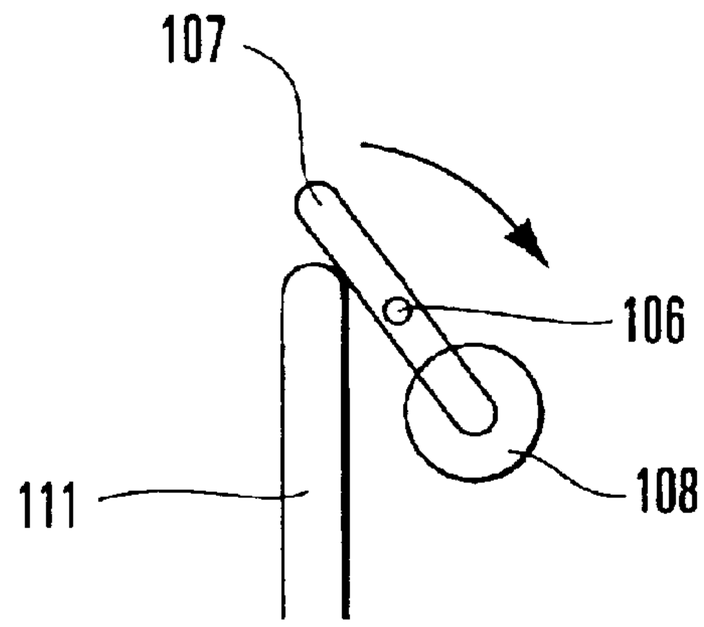

FIG.21B

PLATE INSERTING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a plate inserting apparatus for inserting a new plate into the plate cylinder of a printing press.

A plate inserting apparatus of this type is disclosed in Japanese Patent Laid-Open No. 2001-80041. The plate inserting apparatus disclosed in this reference has a plate holding device for holding a new plate to be fed to a plate cylinder, and a guide device for positioning the new plate fed from the plate holding device and guiding it to the plate cylinder. In the conventional plate inserting apparatus, after the plate holding device moves by a swing motion to a plate feed position where the new plate can be fed to the plate cylinder, the guide device moves to a guide position by a swing motion, and the new plate is fed to the plate cylinder through the guide device.

In the conventional plate inserting apparatus described above, the guide device for positioning the new plate before inserting it to the plate cylinder is provided separately of the plate holding device, and the guide device is provided between the plate holding device and plate cylinder. When mounting the new plate on the plate cylinder, the new plate must be positioned at a plate inserting position by driving the guide device and plate holding device separately. Consequently, the number of air cylinders and the like serving as the driving sources increases. This increases the manufacturing cost, and interferes with downsizing of the entire apparatus.

When the plate becomes large, the diameter of the plate cylinder in the printing unit does not increase in proportion to the size increase of the plate, and the outer shape of the inking device or the like does not increase. Hence, the outer shape of the printing unit itself does not increase. Therefore, in the conventional plate inserting apparatus, when the plate becomes large, the space for installing the guide device runs short, and the plate size increase cannot be coped with.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a plate inserting apparatus that is downsized.

It is another object of the present invention to provide a plate inserting apparatus that can cope with an increase in size of a plate.

In order to achieve the above objects, according to the present invention, there is provided a plate inserting apparatus comprising a loader for holding a new plate inserted in a lateral direction and feeding the new plate to a plate cylinder, a first regulating member for regulating a position of one side edge of the new plate inserted in the loader, a second regulating member for regulating a position of the other side edge of the new plate inserted in the loader, thus positioning the new plate in a widthwise direction in cooperation with the first regulating member, and first moving means for moving the new plate inserted in the loader in a direction substantially perpendicular to a plate surface, thus accommodating the new plate between the first and second regulating members.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view showing the schematic arrangement of a plate changing apparatus for a perfector according to one embodiment of the present invention;

FIG. **2** is a front view of the plate changing apparatus shown in FIG. **1**;

FIG. **3** is a view showing the schematic arrangement of an upper plate changing device in the plate changing apparatus shown in FIG. **1**;

FIG. **4** is an exploded front view of an upper loader forming the upper plate changing device shown in FIG. **3**;

FIG. **5**A is a view showing the schematic arrangement of the upper loader shown in FIG. **3**, and

FIGS. **5**B and **5**C are views showing the shapes of first and second upper regulating members, respectively;

FIG. **6** is an enlarged view showing the distal end portion of the upper loader shown in FIG. **3**:

FIG. **7**A is an enlarged view of the portion VI of FIG. **3** to explain the plate feed operation of the upper loader, and

FIG. **7**B is a view for explaining a second old plate extracting mechanism in detail;

FIG. **8** is an enlarged view of the portion VIII of FIG. **3**;

FIG. **9** is a view seen from the direction of an arrow IX of FIG. **3**;

FIGS. **10**A to **10**E are views showing the states of the loader during plate removal and plate feeding of the plate changing apparatus shown in FIG. **1**;

FIG. **11** is a view showing the schematic arrangement of the lower plate changing device of the plate changing apparatus shown in FIG. **1**;

FIG. **12** is an enlarged view of a portion seen from the direction of an arrow XII of FIG. **11**;

FIG. **13** is a view seen from the direction of an arrow XIII of FIG. **12**;

FIG. **14** is a view showing the schematic arrangement of the lower loader shown in FIG. **11**;

FIG. **15** is an exploded front view of the lower loader shown in FIG. **11**;

FIG. **16** is an enlarged view of the portion XVI of FIG. **14** to explain the plate removal operation of the lower plate changing device;

FIG. **17** is an enlarged view of the portion XVI of FIG. **14** to explain the plate feed operation of the lower plate changing device;

FIG. **18** is an enlarged view of the portion XVIII of FIG. **14**;

FIG. **19** is a view showing the plate removal path and plate feed path of the upper plate changing device shown in FIG. **1**;

FIG. **20** is a view showing the plate removal path and plate feed path of the lower plate changing device shown in FIG. **1**; and

FIGS. **21**A and **21**B are views showing another method of disengaging the bar and the bent portion of the new plate shown in FIG. **8**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A plate exchanging apparatus according to an embodiment of the present invention will be described with reference to FIGS. **1** to **18**. In this embodiment, a case wherein the plate changing apparatus is applied to a perfector will be described.

Referring to FIGS. **1** and **2**, an upper printing section **5**A for printing on the obverse surface of a printing product and a lower printing section **5**B for printing on the reverse surface of the printing product are provided inside a pair of

opposing frames **3** and **4** of a printing unit **1**. The upper printing section **5**A has an upper plate cylinder **6**A with an outer surface where a plate is to be mounted, and an upper blanket cylinder **7**A for coming into contact opposite to the upper plate cylinder **6**A. The lower printing section **5**B has a lower plate cylinder **6**B with an outer surface where the plate is to be mounted, and a lower blanket cylinder **7**B for coming into contact opposite to the lower plate cylinder **6**B. The blanket cylinders **7**A and **7**B are arranged in contact opposite to each other, and a printing target object such as a web passes between them.

When ink and dampening water are supplied to the plate cylinders **6**A and **6**B from an ink supply device (not shown) and dampening device (not shown), respectively, ink portions corresponding to the patterns of the plates mounted on the plate cylinders **6**A and **6**B are transferred to the blanket cylinders **7**A and **7**B, respectively. When the printing target object passes between the blanket cylinders **7**A and **7**B, the patterns are printed on its two surfaces.

The upper printing section **5**A further has an upper plate changing device **17** which removes an old plate mounted on the upper plate cylinder **6**A and feeds a new plate to the upper plate cylinder **6**A. The lower printing section **5**B further has a lower plate changing device **217** which removes the old plate mounted on the lower plate cylinder **6**B and feeds the new plate to the lower plate cylinder **6**B.

<Upper Plate Changing i

The upper plate changing device **17** is constituted by an upper removed plate recovery section **30** which is fixed to the frames **3** and **4**, and an upper loader **20** which guides the old plate removed from the upper plate cylinder **6**A to the upper removed plate recovery section **30** and feeds the new plate to the upper plate cylinder **6**A.

As shown in FIG. **1**, the upper loader **20** is supported by the pair of outer frames **22** and **23** (FIG. **2**) such that it can swing between a wait position (position indicated by a solid line in FIG. **1**) where it is substantially perpendicular to the web convey direction (direction of arrows A–B) and a plate feed position (position indicated by an alternate long and short dashed line in FIG. **1**) where it inclines from the wait position to move its lower end close to the outer surface of the upper plate cylinder **6**A, so that the new plate in the upper loader **20** can be fed to the upper plate cylinder **6**A. The outer frames **22** and **23** are vertically upright on a pair of bases **24** to oppose each other.

A pair of rails **25** extending in the direction of the arrows A–B are fixed to the frames **3** and **4**, respectively, and the bases **24** are supported on the rails **25** to be movable in the direction of the arrows A–B. The bases **24** are moved in the direction of the arrows A–B by a rodless first air cylinder **26** fixed to the frame **4** and extending in the direction of arrows A–B.

When the bases **24** move, the upper loader **20** can move upright in a work space **21** provided between the printing unit **1** and an adjacent printing unit **2** from the wait position indicated by the solid line in FIG. **1** to a retreat position indicated by an alternate long and two short dashed line. A step **27** horizontally fixed to the left and right frames **3** and **4** through support members is provided under the work space **21**.

<Upper Removed Plate Recovery Section>

As shown in FIG. **3**, the upper removed plate recovery section **30** has a flat removed plate guide board **40** fixed between the frames **3** and **4**. The removed plate guide board **40** is formed of a lower inclined portion **41** and an upper upright portion **42** continuous to the inclined portion **41**. The inclined portion **41** inclines at an angle almost equal to the angle of inclination of the upper loader **20** as it is located at the plate feed position, and its lower end comes into contact opposite to the outer surface of the upper plate cylinder **6**A. The upright portion **42** is substantially vertical along the front surface of the printing unit **1**.

A guide rod **43** extending between the frames **3** and **4** and having a U shape when seen from above is fixed to the inclined portion **41**. The guide rod **43** has a large number of rotatable guide rollers **44** at a gap from the surface of the inclined portion **41**. A pair of removal preventive members **45** (only one is shown) are so fixed to the outer frames **22** and **23** as to oppose the two ends in the horizontal direction of the upright portion **42** of the removed plate guide board **40**.

In this arrangement, the old plate **10** removed from the upper plate cylinder **6**A is guided between the guide rollers **44** and the upright portion **42** of the removed plate guide board **40** to move upward, and is subsequently guided by the upright portion **42** and removal preventive members **45** to be recovered by the upper removed plate recovery section **30**. The old plate **10** recovered by the upper removed plate recovery section **30** is removed in the direction of an arrow B in FIG. **3**.

<First Old Plate Extracting Mechanism>

As shown in FIG. **8**, the upright portion **42** of the removed plate guide board **40** has a first old plate extracting mechanism **50**. The first old plate extracting mechanism **50** is schematically constituted by a pair of rodless second air cylinders **51** (FIG. **9**) serving as the driving sources, and a hook **52** for engaging with the bent portion of a trailing edge **10***b* of an old plate **10** removed from the upper plate cylinder **6**A.

As shown in FIG. **9**, the air cylinders **51** extend vertically and are fixed to the frames **3** and **4** (only one is shown), respectively, and movable elements **53** move on them vertically. A connecting member **54** extending between the frames **3** and **4** is vertically movably supported by guide pins **56** respectively fixed to the air cylinders **51** through brackets **55**. When the movable elements **53** move, the connecting member **54** moves integrally with it vertically through connecting elements **57** standing upward from the movable elements **53**.

A support member **58** is attached to the connecting member **54**, and the proximal end of the hook **52** is pivotally supported by a shaft **59** standing upward from the support member **58**. As shown in FIG. **8**, the hook **52** moves forward between the upright portion **42** and the removal preventive members **45** from a notch **60** of the upright portion **42** by its weight. A stopper pin **61** standing upward from the support member **58** engages with the hook **52** moving forward between the upright portion **42** and removal preventive members **45** to hold its forward state.

In this arrangement, when the removed old plate **10** is guided to between the upright portion **42** and removal preventive members **45**, the bent portion of the trailing edge **10***b* abuts against the hook **52**. At this time, the hook **52** pivots about the shaft **59** as the center against Its weight, to temporarily retreat from between the upright portion **42** and removal preventive members **45**. When the old plate **10** moves further upward, the hook **52** and the bent portion of the trailing edge **10***b* are disconnected from each other, and the hook **52** moves forward again to between the upright portion **42** and removal preventive members **45** by its weight.

In this state, when the movable elements **53** of the air cylinders **51** move upward, the hook **52** moves upward. As the hook **52** moves upward, it engages with the lower

surface of the bent portion of the trailing edge **10***b* of the old plate **10**, to pull the old plate **10** upward. According to this embodiment, the hook **52** moves forward to between the upright portion **42** and removal preventive members **45** by its weight. Hence, no driving source is necessary for moving the hook **52**, so that the structure can be simplified and downsized.

<Upper Loader>

As shown in FIG. **4**, the upper loader **20** has a pair of inner frames **71** and **72** opposing each other at a gap larger than the width of the new plate **11**. As shown in FIG. **5**A, the inner frame **72** has a slit-like elongated hole **73** formed along its longitudinal direction so that the new plate **11** can be inserted from the side surface of the upper loader **20**. As shown in FIG. **4**, a flat plate-like first regulating member **74** is fixed inside the inner frame **71** to be parallel with the inner frame **71**. One side edge of a new plate **11** inserted from the elongated hole **73** abuts against the first regulating member **74**.

A flat plate-like second regulating member **75** opposing the first regulating member **74** is provided inside the inner frame **72**. The second regulating member **75** is smaller than the first regulating member **74** by the elongated hole **73**, as shown in FIGS. **5**B and **5**C, such that it will not regulate insertion of the new plate **11** inserted from the elongated hole **73**. More specifically, the first regulating member **74** has a shape overlapping the elongated hole **73** such that one side edge of the new plate **11** abuts against the first regulating member **74** when inserting the plate. The second regulating member **75** has a size smaller than that of the first regulating member **74** by a size corresponding to the width of the elongated hole **73**, so that one side edge of the new plate **11** will not abut against the second regulating member **75** when inserting the plate.

The second regulating member **75** is supported by the inner frame **72** to be movable in directions to come close to and separate from the first regulating member **74**. The second regulating member **75** is moved by a third air cylinder **77** (FIG. **4**), fixed to the inner frame **72**, toward the first regulating member **74** slightly from the initial position (the direction of an arrow C in FIG. **4**). Each of the first and second regulating members **74** and **75** is divided into upper and lower regulating members, only part of which is shown in FIG. **4**.

In this arrangement, the new plate **11** inserted from the elongated hole **73** abuts against the first regulating member **74** with its one side edge, is moved by an oscillating mechanism (to be described later) in a direction perpendicular to a direction toward the surface of the new plate **11**, and is accommodated loosely in a plate accommodating section **78** formed between the two regulating members **74** and **75**. Subsequently, the air cylinder **77** moves the second regulating member **75** toward the first regulating member **74**, so the two regulating members **74** and **75** position the new plate **11** in the widthwise direction.

Alternatively, the new plate **11** can be positioned in the widthwise direction by tapering the inner side surface of the second regulating member **75**, i.e., that surface of the second regulating member **75** against which the other side edge of the new plate **11** abuts. In this case, the second regulating member **75** need not be moved. If the new plate **11** can be accommodated between the two regulating members **74** and **75** by only the operation of the oscillating mechanism, the gap between the two regulating members **74** and **75** may be set equal to the length in the widthwise direction of the new plate **11**. In this case, the second regulating member **75** need not be moved, or the inner side surface of the second regulating member **75** need not be tapered.

<Upper Oscillating Mechanism>

A shaft **81** horizontally extends between the upper ends of the inner frames **71** and **72**, as shown in FIG. **4**. A pair of thin elongated rectangular support plates **82** have upper ends pivotally supported by the shaft **81**, and lower ends extending to near the lower end of the upper loader **20**. As shown in FIG. **5**A, the support plates **82** have a large number of oscillating rollers **83** that come into contact with the new plate **11** inserted from the elongated hole **73** and supported by bars **108**.

As shown in FIG. **4**, a pair of fourth air cylinders **85** are fixed inside the inner frames **71** and **72**. One end of each lever **86** is pivotally mounted on the cylinder rod end of the corresponding fourth air cylinder **85**, as shown in FIG. **5**A. The other end of each lever **86** is fixed to a shaft **87** rotatably supported between the inner frames **71** and **72**. Thus, the shaft **87** pivots clockwise and counterclockwise in accordance with the forward and backward movement of the rods of the fourth air cylinders **85**.

The proximal ends of a pair of levers **88** are fixed to the shaft **87**, and elongated holes **89** are formed in the pivoting portions of the levers **88**. A shaft **90** extending between the inner frames **71** and **72** is rotatably supported between the elongated holes **89** through bearings. One end of each of a plurality of levers **91** is fixed to the shaft **90**, and the other end of each lever **91** rotatably supports a corresponding one of press rollers **92**. The lower ends of the support plates **82** are fixed to the shaft **90** through plates **93**.

In this arrangement, when the rods of the fourth air cylinders **85** move backward, the shaft **87** pivots counterclockwise in FIG. **6**, so the levers **88** pivot counterclockwise about the shaft **87** as the center integrally with the shaft **87**. When the levers **88** pivot, the support plates **82** pivot clockwise in FIG. **5**A, so the oscillating rollers **83** also move in the direction of an arrow E. Thus, the new plate **11** is supported by the rollers **83** serving as the oscillating mechanism (member) and is accommodated between the two regulating members **74** and **75**, as described above.

When the lower ends of the support plates **82** move in the direction of the arrow E, the levers **91** also move in the direction of the arrow E through the shaft **90**. Accordingly, the press rollers **92** press a leading edge **11***a* of the new plate **11** in the direction of the arrow E, to position the new plate **11** with respect to a plate gripper **8**A of the upper plate cylinder **6**A.

<New Plate Support Mechanism>

A pair of rodless fifth air cylinders **100** are fixed inside the inner frames **71** and **72**, as shown in FIG. **4**. The fifth air cylinders **100** drive movable elements **101** to move vertically. The two ends of a movable rod **102** extending between the inner frames **71** and **72** are connected to the movable elements **101** through connecting elements **110***a*. When the movable elements **101** move, the movable rod **102** moves upward integrally as it is guided by a pair of guide rods **103**.

A pair of bases **105** are fixed to the movable rod **102** to be separate from each other by a predetermined distance, and press portions **105***a* having inverted-L-shaped sections are fixed to the bases **105**, as shown in FIG. **8**. Support members **107** are rotatably supported by shafts **106** horizontally extending on the bases **105**, respectively, and a pair of bars **108** horizontally, continuously extending between the inner frames **71** and **72** are fixed to the support members **107**, as shown in FIG. **4**.

As shown in FIG. **8**, stopper pins **109** to engage with the support members **107** stand upward from the bases **105**, respectively. The stopper pins **109** regulate the downward pivot motions of the respective support members **107** by

their weights, so that the support members **107** are held in substantially the horizontal state, i.e., in a state of having moved forward into the plate accommodating section **78**. Square-ring-like locking members **111** extend vertically on a rod **112** horizontally extending between the inner frames **71** and **72**, to correspond to the support members **107**, as shown in FIG. **4**.

In this arrangement, when the movable elements **101** of the air cylinders **100** move downward and the support members **107** also move downward, the leading edge **11***a* of the new plate **11** supported by the bars **108** abuts against the upper plate cylinder **6**A and a plate holding roller **135**. Subsequently, when the support members **107** abut against the upper ends of the locking members **111** and move further downward, they pivot counterclockwise about the shafts **106** as the center against their weights, as shown in FIG. **8**.

The support members **107** pivot counterclockwise about the shafts **106** as the centers, to disengage the new plate **11** and bars **108** from each other. Alternatively, as shown in FIGS. **21**A and **21**B, the support members **107** may pivot clockwise to disengage the new plate **11** and bars **108** from each other. In this case, the shafts **106** may be provided closer to the new plate **11** than the support members **107**.

Therefore, the bars **108** retreat from the plate accommodating section **78**, and accordingly the bars **108** and the bent portion of a trailing edge **11***b* of the new plate **11** are disengaged from each other. Subsequently, the press portions **105***a* press the trailing edge **11***b* of the new plate **11**, so that the leading edge **11***a* can be inserted in the upper plate cylinder **6**A. In this manner, when the bars **108** and new plate **11** are to be disengaged from each other, no driving mechanism for pivoting the bars **108** is necessary. Thus, the structure is simplified.

A guide bar **120** is horizontally attached to the upper end of the outer frame **23** close to the inner frame **72** having the elongated hole **73**, as shown in FIG. **4**. The guide bar **120** is provided at a position slightly higher than the bars **108**. Thus, when the new plate **11** is to be inserted from the elongated hole **73** into the upper loader **20**, as will be described later, the bent portion of the trailing edge **11***b* of the new plate **11** is placed on the guide bar **120** temporarily, so that the bent portion of the trailing edge **11***b* is smoothly and reliably guided and supported by the bars **108**.

<Plate Removal/Feed Switching Guide Board>

As shown in FIG. **4**, sixth air cylinders **130** are fixed inside the inner frames **71** and **72**. One end of each lever **131** is pivotally mounted on the rod end of the corresponding air cylinder **130**, as shown in FIG. **6**. The levers **131** are pivotally supported by shafts **132** standing upward from the inner frames **71** and **72**. A plate removal/feed switching guide board **133** is attached to the other end of one lever **131** and the other end of the other lever **131**.

In this arrangement, when the rods of the air cylinders **130** move backward, the plate removal/feed switching guide board **133** pivots in the direction of an arrow E about the shafts **132** as the pivot center, as indicated by a solid line in FIG. **6**, so that the new plate **11** can be inserted in the upper plate cylinder **6**A. When the rods of the air cylinders **130** move forward, the plate removal/feed switching guide board **133** pivots in the direction of an arrow F about the shafts **132** as the pivot center, so that the old plate **10** can be removed from the upper plate cylinder **6**A.

The plate holding roller **135** moves close to and away from the outer surface of the upper plate cylinder **6**A by an air cylinder (not shown). In plate feeding, when the plate holding roller **135** comes into contact opposite to the outer surface of the upper plate cylinder **6**A, it inserts the bent portions of the leading edge **11***a* and trailing edge **11***b* of the new plate **11** into the plate gripper **8**A of the upper plate cylinder **6**A, and presses the new plate **11** to come into tight contact with the outer surface of the upper plate cylinder **6**A.

<Second Old Plate Extracting Mechanism>

As shown in FIG. **4**, seventh air cylinders **140** are fixed outside the inner frames **71** and **72**. As shown in FIG. **7**B, one end of each lever **141** is pivotally mounted on the rod end of the corresponding air cylinder **140**, and one end of a corresponding lever **142** is pivotally mounted on the other end of the lever **141**. The other end of the lever **142** is axially mounted on a corresponding one of shafts **143** pivotally supported by the inner frames **71** and **72**. The proximal end of a second old plate extracting lever **144** extending between the inner frames **71** and **72** is axially mounted on the shafts **143**.

In this arrangement, when the rods of the air cylinders **140** move forward, the shafts **143** pivot counterclockwise in FIG. **7**B through the levers **141** and **142**. As the shafts **143** pivot, a swing end **144***a* of the second old plate extracting lever **144** moves in the direction of an arrow F from the position indicated by a solid line to the position indicated by an alternate long and short dashed line. Thus, the swing end **144***a* of the second old plate extracting lever **144** engages with a leading edge **10***a* of the old plate **10**, and the bent portion of the leading edge **10***a* of the old plate **10** is forcibly extracted from the plate gripper **8**A of the upper plate cylinder **6**A.

As shown in FIG. **4**, eighth air cylinders **150** having pivotally supporting cylinder ends are fixed inside the inner frames **71** and **72**. One end of each lever **151** is pivotally mounted on the rod end of the corresponding air cylinder **150**, as shown in FIG. **7**A. The levers **151** are axially supported by the inner frames **71** and **72** to be pivotal about shafts **152** as the pivot centers, respectively, and a guide bar **153** extending between the inner frames **71** and **72** horizontally extends between the other end of one lever **151** and the other end of the other lever **151**, as shown in FIG. **4**. A plurality of fulcrum rollers **155** are rotatably supported by the guide bar **153**.

In this arrangement, when the rods of the air cylinders **150** move forward, the levers **151** pivot clockwise about the shafts **152** as the pivot centers. As the levers **151** pivot, the fulcrum rollers **155** move in the direction of an arrow E in FIG. **7**A from the position indicated by a solid line to the position indicated by an alternate long and two short dashed line. As the fulcrum rollers **155** move, they press the old plate **10** removed from the upper plate cylinder **6**A toward the upper plate cylinder **6**A. Thus, the old plate **10** can be reliably extracted by the second old plate extracting lever **144** described above with the fulcrum rollers **155** as the fulcrum.

As shown in FIG. **5**A, three removed plate guide boards **161**, **162**, and **163** are fixed to the lower end of the upper loader **20** sequentially between the inner frames **71** and **72**. The removed plate guide board **161** opposes the plate removal/feed switching guide board **133**, and the removed plate guide boards **162** and **163** oppose the inclined portion **41** of the removed plate guide board **40** fixed to the frames **3** and **4**. In this arrangement, the old plate **10** removed from the upper plate cylinder **6**A passes between the removed plate guide board **161** and plate removal/feed switching guide board **133**, and is guided to between the removed plate guide boards **162** and **163** and the inclined portion **41** of the removed plate guide board **40**.

<Swing Motion of Upper Loader>

The upper loader **20** is swingably supported by the outer frames **22** and **23** through support shafts **170**, as shown in

FIG. **3**. The cylinder ends of a pair of ninth air cylinders **171** having rods **172** are pivotally supported inside the outer frames **22** and **23**, as shown in FIG. **4**. The rod ends of the rods **172** are pivotally mounted on the inner frames **71** and **72**, respectively.

In this arrangement, when the rods **172** of the air cylinders **171** move forward, the upper loader **20** inclines, and its lower end is positioned at a plate feed position close to the outer surface of the upper plate cylinder **6**A, as shown in FIG. **3**. When the rods **172** of the air cylinders **171** are moved backward, the upper loader **20** becomes vertical and is positioned at the wait position.

<Plate Change Operation of Upper Plate Cylinder>

First, the upper loader **20** is moved from the retreat position to the wait position, as shown in FIG. **10**A. More specifically, upon actuation of the air cylinder **26** (FIG. **2**), the upper loader **20** moves in the direction of an arrow A from the retreat position indicated by an alternate long and two short dashed line in FIG. **1** to the wait position indicated by a solid line, to be close to the printing unit **1**.

In the upper loader **20** located at the wait position, the bent portion of the trailing edge **11***b* of the new plate **11** is caught by the guide bar **120**, and the new plate **11** is moved in the direction of an arrow C so that it is inserted in the upper loader **20** from the elongated hole **73** of the inner frame **72**. Subsequently, the bent portion of the trailing edge **11***b* of the new plate **11** is transferred from the guide bar **120** to the bars **108** (FIG. **4**), so that the new plate **11** suspends vertically by its weight and is supported by the bars **108**.

Then, the rods **172** of the air cylinders **171** move forward, and accordingly the upper loader **20** inclines and is positioned at the plate feed position, as indicated by an alternate long and short dashed line in FIG. **1**. In this state, the upper and lower blanket cylinders **7**A and **7**B are disengaged from each other, and a clutch (not shown) between the driving mechanism of the printing unit **2** and the driving mechanism of a folding machine (not shown) is disconnected. Subsequently, the driver of the printing press is driven, so that the upper and lower plate cylinders **6**A and **6**B rotate through almost one turn in the forward direction (clockwise in FIG. **10**B), as shown in FIG. **10**B.

At this time, a web **15** located between the printing unit **1** and the folding machine slacks by an amount substantially corresponding to the length of the circumference of the upper plate cylinder **6**A. An air cylinder (not shown) is actuated to move a dancer roller **16** downward, thus removing the slack. Subsequently, the rods of the air cylinders **130** (FIG. **7**A) move forward, so that the plate removal/feed switching guide board **133** moves in a direction of an arrow F to be positioned at the plate removal position. The plate holding roller **135** is then brought into contact opposite to the outer surface of the upper plate cylinder **6**A.

Subsequently, the reel rod of the plate gripper **8**A pivots, and the trailing edge **10***b* of the old plate **10** disengages from the upper plate cylinder **6**A and pops up from the outer surface of the upper plate cylinder **6**A. Then, when the upper plate cylinder **6**A rotates in the opposite direction (counterclockwise in FIG. **7**A), the trailing edge **10***b* of the old plate **10** passes between the removed plate guide board **161** and plate removal/feed switching guide board **133**, and is guided to between the removed plate guide boards **162** and **163** and the inclined portion **41** of the removed plate guide board **40**. FIG. **19** shows a plate removal path X in this state.

In this manner, since the removed plate guide board **161** for guiding the old plate **10** removed from the upper plate cylinder **6**A and the plate removal/feed switching guide board **133** are provided to the distal end of the upper loader **20** which comes into contact opposite to the outer surface of the upper plate cylinder **6**A, the old plate **10** can be reliably guided to the upper removed plate recovery section **30** through the upper loader **20**. Subsequently, the upper plate cylinder **6**A rotates in the opposite direction (counterclockwise in FIG. **7**A), and accordingly the trailing edge **10***b* of the old plate **10** is guided to between the upright portion **42** of the removed plate guide board **40** and the removal preventive members **45**, as shown in FIG. **8**.

At this time, the bent portion of the old plate **10** abuts against the hook **52**, and the hook **52** temporarily retreats from between the upright portion **42** of the removed plate guide board **40** and the removal preventive members **45**. Subsequently, when this abutting state is released as the bent portion of the trailing edge **10***b* passes, the hook **52** moves forward again from the plate removal path by its weight. When the hook **52** is restored, the plate removal operation accompanying the pivot motion of the upper plate cylinder **6**A is stopped (the old plate **10** moves upward) substantially simultaneously, and the lower surface of the bent portion of the trailing edge **10***b* engages with the hook **52**.

At the same time, as shown in FIG. **7**A, the plate holding roller **135** separates from the upper plate cylinder **6**A, and the rods of the air cylinders **150** move forward, so that the fulcrum rollers **155** move in the direction of the arrow E to press the trailing edge **10***b* of the old plate **10** removed from the upper plate cylinder **6**A toward the upper plate cylinder **6**A.

Subsequently, the rods of the air cylinders **140** move forward, so that the second old plate extracting lever **144** moves in the direction of the arrow F, to extract the leading edge **10***a* of the old plate **10** from the plate gripper **8**A of the upper plate cylinder **6**A. Then, the movable elements **53** of the air cylinders **51** (FIG. **9**) move upward, and accordingly the hook **52** pulls up the old plate **10**.

In this manner, the leading edge **10***a* of the old plate **10** pressed by the fulcrum rollers **155** is extracted from the plate gripper **8**A of the upper plate cylinder **6**A by the second old plate extracting lever **144**, and after that the trailing edge **10***b* of the old plate **10** is pulled up by the hook **52**. Therefore, the old plate **10** can be removed from the upper plate cylinder **6**A reliably. The removed old plate **10** is recovered and held in the upper removed plate recovery section **30** on the frames **3** and **4** side. The old plate **10** recovered in the upper removed plate recovery section **30** is removed from it by the operator when the next plate feed operation is ended, as will be described later.

<Plate Feed Operation>

Upon actuation of an air cylinder (not shown), the plate holding roller **135** comes into contact opposite to the outer surface of the upper plate cylinder **6**A, as shown in FIG. **6**. Subsequently, the rods of the air cylinders **130** move backward, so that the plate removal/feed switching guide board **133** moves in the direction of the arrow E, and is positioned at the plate feed position. Subsequently, the rods of the air cylinders **85** are moved backward, in order to urge, between the two regulating members **74** and **75**, the new plate **11** which is inserted from the elongated hole **73**, is hung from the bars **108**, and is in abutment against the first regulating member **74** with its one side edge.

As the rods of the fourth air cylinders **85** move backward, the support plates **82** pivot clockwise about the shaft **81** as the pivot center, as shown in FIG. **5**A. Then, the oscillating rollers **83** also move in the direction of the arrow E of FIG. **5**A, and the new plate **11** in contact with the oscillating rollers **83** is accommodated between the two regulating members **74** and **75**. At this time, when the lower ends of the

support plates **82** move in the direction of the arrow E, the levers **91** move in the direction of the arrow E through the shaft **90**. Hence, the press rollers **92** press the leading edge **11***a* of the new plate **11** in the direction of the arrow E, so that it is positioned to correspond to the plate gripper **8**A of the upper plate cylinder **6**A.

Simultaneously, the air cylinder **77** (FIG. **4**) is driven to move the second regulating member **75** toward the first regulating member **74**, so that the two regulating members **74** and **75** position the new plate **11** in the widthwise direction. In this manner, since a mechanism for positioning the new plate **11** before being inserted in the upper plate cylinder **6**A is provided in the upper loader **20**, no guide unit for guiding the new plate **11** to between the upper loader **20** and upper plate cylinder **6**A need be provided, unlike in the prior art. As a result, not only the apparatus can be downsized, but also the plate size increase can be coped with.

The movable elements **101** of the air cylinders **100** (FIG. **8**) move downward, and accordingly the support members **107** move downward. Then, the leading edge **11***a* of the new plate **11** supported by the bars **108** abuts against the upper plate cylinder **6**A and plate holding roller **135**, so that the downward movement of the new plate **11** is stopped. After that, the support members **107** abut against the upper ends of the locking members **111**. When the support members **107** move further downward, they pivot counterclockwise about the shafts **106** as the centers, and the bars **108** retreat from the plate accommodating section **78**. Subsequently, the trailing edge **11***b* is pressed by the press portions **105***a*, so that the leading edge **11***a* can be inserted in the plate gripper **8**A of the upper plate cylinder **6**A.

In this state, when the upper plate cylinder **6**A rotates in the forward direction indicated by an arrow in FIG. **6**, the leading edge **11***a* of the new plate **11** abutting against the upper plate cylinder **6**A and plate holding roller **135** is inserted into the plate gripper **8**A by the plate holding roller **135**. The upper plate cylinder **6**A rotates through almost one turn, and accordingly the trailing edge **11***b* of the new plate **11** is inserted in the plate gripper **8**A. When the reel rod of the plate gripper **8**A is subsequently pivoted, the new plate **11** is mounted on the outer surface of the upper plate cylinder **6**A. FIG. **19** shows a plate feed path Y of this case.

When mounting of the new plate **11** is ended, the rods **172** of the air cylinders **171** (FIG. **3**) move backward, so that the upper loader **20** is set in the vertical state and positioned at the wait position. Subsequently, the air cylinder **26** (FIG. **2**) is actuated to separate the upper loader **20** from the printing unit **1** and to position it at the wait position, as indicated by an alternate long and two short dashed line in FIG. **1**. FIG. **10**E shows this state. After that, the clutch between the driving mechanism of the printing unit **2** and the driving mechanism of the folding machine (not shown) is connected, as shown in FIG. **10**E, to drive the driver of the printing press. Subsequently, the dancer roller **16** is moved upward, and the operator pulls the old plate **10** recovered in the upper removed plate recovery section **30** in the direction of the arrow B, to extract it to the work space **21**.

In this manner, since the old plate **10** is recovered in the upper removed plate recovery section **30** provided to the frames **3** and **4**, no unit for recovering the old plate **10** need be provided in the upper loader **20**, and the upper loader **20** can be downsized in the sheet convey direction (direction of the arrows A–B). Since the upper loader **20** is moved to the retreat position, the work space of the upper removed plate recovery section **30** fixed to the frames **3** and **4** becomes large, and accordingly the old plate **10** can be removed from the upper loader **20** easily.

Since the upper loader **20** itself can be downsized and made lightweight, the air cylinders **171** and **26** for swinging and moving the upper loader **20** can be downsized, so that the apparatus can be downsized.

<Lower Plate Changing Device>

As shown in FIG. **1**, the lower plate changing device **217** is constituted by a lower removed plate recovery section **230** fixed to the frames **3** and **4**, and an lower loader **220** for guiding the old plate removed from the lower plate cylinder **6**B to the lower removed plate recovery section **230** and feeding a new plate to the lower plate cylinder **6**B.

The lower loader **220** is supported by a pair of outer frames **222** and **223** such that it can swing between a wait position (position indicated by a solid line in FIG. **1**) where it is substantially perpendicular to the web convey direction (direction of the arrows A–B) and the plate feed position (position indicated by the alternate long and short dashed line in FIG. **1**) where it inclines from the wait position and its upper end is close to the outer surface of the lower plate cylinder **6**B. At the plate feed position, the new plate in the lower loader **220** can be fed to the lower plate cylinder **6**B.

As shown in FIG. **2**, the outer frames **222** and **223** stand upright on a pair of bases **224** to oppose each other. Rails **225** extending in the direction of the arrows A–B (FIG. **1**), i.e., in the aligning direction of the printing unit **1** and a printing unit **2**, are fixed to the frames **3** and **4**, respectively, and the bases **224** are supported on the rails **225** to be movable in the direction of the arrows A–B. The bases **224** are moved in the direction of the arrows A–B by a rodless 10th air cylinder **226** fixed to the frame **3**.

As the bases **224** move, the lower loader **220** can also move between the wait position and the retreat position indicated in FIG. **1** by the solid line and the alternate long and two short dashed line, respectively, through a work space **221** formed between the printing units **1** and **2**. Under the work space **221**, a step **227** is horizontally fixed to the frames **3** and **4** through support members (not shown).

<Lower Removed Plate Recovery Section>

As shown in FIG. **11**, the lower removed plate recovery section **230** has a flat plate-like removed plate guide board **231** fixed to the frames **3** and **4** and provided substantially vertically on the front surface of the printing unit. The upper end portion of the removed plate guide board **231** is curved, so that its upper end comes close to the outer surface of the lower plate cylinder **6**B. A pair of removal preventive members **232** (only one is shown) are fixed to the outer frames **222** and **223** to oppose the two ends in the horizontal direction of the removed plate guide board **231**.

In this arrangement, the old plate **10** removed from the lower plate cylinder **6**B is guided downward between the removed plate guide board **231** and removal preventive members **232**. The old plate **10** recovered in the removed plate recovery section **210** is removed in the direction indicated by an arrow B in FIG. **11**.

<First Old Plate Extracting Mechanism>

As shown in FIG. **12**, a first plate extracting mechanism **240** is provided below the removed plate guide board **231** and removal preventive members **232**, to extract the leading edge **10***a* of the old plate **10** from a gripper **8**B of the lower plate cylinder **6**B in plate removal.

As shown in FIG. **13**, a base board **242** is fixed to two studs **241** projecting from the frame **4**, and the cylinder end of an 11th air cylinder **243** is pivotally mounted on the base board **242**. A rod **244** of the air cylinder **243** is pivotally mounted on a curved swing member **245**, as shown in FIG. **12**. The proximal end of the swing member **245** is supported by the base board **242** to be swingable about a shaft **246** as

the center. A hook **247** is rotatably supported at the swing end of the swing member **245** through a shaft **248**.

The hook **247** is biased by a torsion coil spring **249** (FIG. **13**) wound on the shaft **248** to be pivotal counterclockwise in FIG. **12**, and its pivot motion is regulated by a stopper pin **250** projecting from the base board **242**. In this arrangement, in the initial state where the rod **244** of the air cylinder **243** has moved backward, the hook **247** pivots clockwise in FIG. **12** through the engagement with the stopper pin **250** against the torsion coil spring **249**, and retreats from the removed plate guide board **231** as indicated by a solid line in FIG. **12**. When the rod **244** of the air cylinder **243** moves slightly forward, the swing member **245** pivots clockwise slightly about the shaft **246** as the pivot center, so that the hook **247** separates from the stopper pin **250** while pivoting clockwise.

Hence, the hook **247** moves forward from the removed plate guide board **231** into the plate removal path by the biasing force of the torsion coil spring **249**, and is held horizontally in the forward state by another stopper pin **251** standing upward from the swing member **245**. A receiving guide board **252** fixed to the frames **3** and **4** holds the trailing edge **10***b* of the old plate **10** removed from the lower plate cylinder **6**B.

In this arrangement, in plate removal, when the trailing edge **10***b* of the old plate **10** guided between the removed plate guide board **231** and removal preventive members **232** passes the hook **247**, the rod **244** of the air cylinder **243** moves forward substantially simultaneously. Upon the forward movement of the rod **244**, the hook **247** moves forward from the removed plate guide board **231** into the plate removal path, and the lower surface of the bent portion of the trailing edge **10***b* of the old plate **10** engages with the hook **247**. When the rod **244** of the air cylinder **243** moves further forward, the swing member **245** rotates clockwise about the shaft **246** as the rotation center. Thus, the swing end of the swing member **245** moves along the receiving guide board **252**, so that the old plate **10** with its trailing edge **10***b* engaging with the hook **247** is forcibly pulled downward.

<Lower Loader>

The lower loader **220** has a pair of inner frames **261** and **262** arranged to oppose each other at a gap larger than the width of the new plate **11**, as shown in FIG. **15**. As shown in FIG. **14**, the inner frame **261** has a slit-like elongated hole **263** along the longitudinal direction of the frame to allow insertion of the new plate **11**. A flat plate-like first regulating member **264** is fixed inside the inner frame **262** to be parallel to it, as shown in FIG. **15**. One side edge of the new plate **11** inserted from the elongated hole **263** abuts against the first regulating member **264**.

A plate-like second regulating member **265** is provided inside the inner frame **261** to oppose the first regulating member **264**. As shown in FIG. **14**, the second regulating member **265** has an outer shape smaller than the first regulating member **264** by the elongated hole **263**, so it will not regulate insertion of the new plate **11** inserted from the elongated hole **263**. The second regulating member **265** can be slightly moved toward the first regulating member **264** (in the direction of an arrow D in FIG. **15**) by a 12th air cylinder **266** fixed to the inner frame **261**. Note that each of the first and second regulating members **264** and **265** is divided into two members, i.e., upper and lower regulating members, only part of which is shown in FIG. **15**.

In this arrangement, the new plate **11** inserted from the elongated hole **263** abuts against the first regulating member **264** with its one side edge, and is moved by an oscillating mechanism (to be described later) (bars **295**) in a direction perpendicular to a direction toward the surface of the new plate **11**, and is stored in a plate storing section **267** formed between the two regulating members **264** and **265**. After this, the air cylinder **266** moves the second regulating member **265** toward the first regulating member **264**, so the two regulating members **264** and **265** position the new plate **11** in the widthwise direction.

<Second Old Plate Extracting Mechanism>

As shown in FIG. **15**, a pair of 13th air cylinders **270** are fixed outside the inner frames **261** and **262**. As shown in FIG. **16**, the rod end of each air cylinder **270** is pivotally mounted on one end of a corresponding lever **271** having a triangular shape, when seen in the side view, and rotatably supported by a corresponding shaft **272** standing upward from the corresponding one of the inner frames **261** and **262**.

The other end of the lever **271** and one end of a corresponding lever **274***a* are connected to each other by a link **273**, and a pin **274** pivotally, axially supported by the inner frame **261** or **262** is axially mounted on the other end of the lever **274***a*. The proximal end of a second old plate extracting lever **275** is axially mounted on the pin **274**. In this arrangement, when the rods of the air cylinders **270** move forward, the levers **271** pivot counterclockwise in FIG. **16** about the shafts **272** as the centers, respectively, and the shafts **274** pivot clockwise through the links **273** and levers **274***a*.

The second old plate extracting member **275** axially mounted on the shafts **274** pivots clockwise integrally with them about them as the pivot centers, and its swing end **275***a* moves from a position indicated by a solid line to a position indicated by an alternate long and two short dashed line. Thus, the swing end **275***a* of the second old plate extracting member **275** engages with the leading edge **10***a* of the old plate **10** during plate removal, so that the old plate **10** is forcibly extracted from the plate gripper **8**B of the lower plate cylinder **6**B.

As shown in FIG. **15**, the cylinder ends of a pair of 14th air cylinders **280** are pivotally supported inside the inner frames **261** and **262**. One end of each lever **282** is pivotally mounted on the rod end of the corresponding air cylinder **280**, as shown in FIG. **16**. The levers **282** are supported by the inner frames **261** and **262** to be pivotal about shafts **281** as pivot centers. The two ends of a support bar **282***a* extending between the inner frames **261** and **262** are fixed to the other end of one lever **282** and the other end of the other lever **282**, as shown in FIG. **15**. A plurality of fulcrum rollers **283** are rotatably supported by the support bar **282***a*.

In this arrangement, when the rods of the air cylinders **280** (FIG. **16**) move forward, the levers **282** pivot counterclockwise about the shafts **281** as the pivot centers, and the fulcrum rollers **283** move in the direction of an arrow H. The fulcrum rollers **283** abut against the outer surface of the lower plate cylinder **6**B, to press the leading edge **10***a* of the old plate **10** removed from the lower plate cylinder **6**B toward the lower plate cylinder **6**B. Thus, the old plate **10** is reliably extracted by the second old plate extracting lever **275** described above with the fulcrum rollers **283** as the fulcrum.

<Plate Removal/Feeding Switching Guide Board>

A pair of 15th air cylinders **290** with pivotally supported cylinder ends are provided inside the inner frames **261** and **262**, as shown in FIG. **15**. One end of each lever **291** is pivotally mounted on the rod end of the corresponding air cylinder **290**, as shown in FIG. **17**. Shafts **292** pivotally supported by the inner frames **261** and **262** are axially mounted on the other end of one lever **291** and the other end of the other lever **291**, and the proximal end of the plate removal/feed switching guide board **293** is fixed to the shafts

292. The plate removal/feed switching guide board **293** extends between the inner frames **261** and **262**, and its swing end swings about the shafts **292** as the rotation center.

In this arrangement, when the rods of the air cylinders **290** move forward, a plate removal/feed switching guide board **293** pivots clockwise in FIG. **17** about the shafts **292** as the rotation center, to move to the plate removal position indicated by an alternate long and two short dashed line. When the plate removal/feed switching guide board **293** is located at the plate removal position, it can guide the old plate **10** removed from the lower plate cylinder **6**B to the removed plate recovery section **230**. When the rods of the air cylinders **290** move backward, the plate removal/feed switching guide board **293** pivots counterclockwise (in the direction of an arrow J in FIG. **17**) about the shafts **292** as the pivot center, to move the new plate **11** to the plate feed position (solid line) where the new plate **11** can be inserted in the lower plate cylinder **6**B.

As shown in FIG. **17**, a pair of bars **295** are fixed to the swing end of the plate removal/feed switching guide board **293**, and extend between the inner frames **261** and **262**, as shown in FIG. **15**. When the plate removal/feed switching guide board **293** is positioned at the plate removal position (alternate long and two short dashed line) in FIG. **17**, the bars **295** are located at the upper end of the elongated hole **263**. When the plate removal/feed switching guide board **293** is located at the plate feed position (solid line), the bars **295** come close to the outer surface of the lower plate cylinder **6**B, to move the old plate **10** hung from the bars **295** to an insertion position where the old plate **10** can be inserted into the plate gripper **8**B of the lower plate cylinder **6**B.

As shown in FIG. **15**, a guide bar **296** is horizontally attached to the upper end of the outer frame **222** close to the inner frame **261** having the elongated hole **263**. The guide bar **296** is provided at a position slightly higher than the bars **295**. When inserting the new plate **11** into the lower loader **220** from the elongated hole **263**, the bent portion of the leading edge **11***a* of the new plate **11** is temporarily placed on the guide bar **296**. Subsequently, the bent portion of the leading edge **11***a* is smoothly and reliably guided from the guide bar **296** to the bars **295**, and is supported by the bars **295**.

The lower loader **220** has a removed plate guide **297** to oppose the plate removal/feed switching guide board **293**, as shown in FIG. **17**. The removed plate guide **297** guides the old plate **10** removed from the lower plate cylinder **6**B to a removed plate recovery section **210**. A plate press roller **298** can come close to and separate from the outer surface of the lower plate cylinder **6**B by an air cylinder (not shown). When feeding a plate, the plate press roller **298** comes into contact opposite to the outer surface of the lower plate cylinder **6**B, to insert the leading edge **11***a* and trailing edge **11***b* of the new plate **11** in the plate gripper **8**B of the lower plate cylinder **6**B, and to mount the new plate **11** in tight contact with the outer surface of the lower plate cylinder **6**B.

<New Plate Pushout Mechanism>

A pair of rodless 16th air cylinders **300** are fixed inside the inner frames **261** and **262** through brackets **301**, as shown in FIG. **15**. The air cylinders **300** have movable elements **302** that move along guide bars **303**, respectively. A movable rod **304** extending between the inner frames **261** and **262** has two ends connected to the movable elements **302** through connecting elements **302***a*. When the movable elements **302** guided by the guide bars **303** move, the movable rod **304** vertically moves integrally with the movable elements **302**.

The movable rod **304** has a pair of bent pressing portions **304***a*, as shown in FIG. **18**. When the movable elements **302** are located at the lower end, the pressing portions **304***a* are inserted from the elongated hole **263**, and are positioned immediately under the trailing edge **11***b* of the new plate **11** supported by the bars **295**. In this state, the movable elements **302** of the air cylinders **300** move upward in the direction of an arrow K to the position indicated by an alternate long and two short dashed line, so that the pressing portions **304***a* abut against the trailing edge **11***b* of the new plate **11**. Thus, the trailing edge **11***b* of the new plate **11** is caught by the pressing portions **304***a* and moves upward, to position the leading edge **11***a* of the new plate **11** to a position where the leading edge **11***a* can be inserted in the plate gripper **8**B of the lower plate cylinder **6**B.

<Swing Motion of Lower Loader>

The lower loader **220** is swingably supported by the outer frames **222** and **223** through support shafts **312**, as shown in FIG. **11**. The cylinder ends of a pair of 17th air cylinders **310** are pivotally supported inside the outer frames **222** and **223**. The rod ends of rods **311** of the air cylinders **310** are respectively pivotally mounted on the inner frames **261** and **262**, as shown in FIG. **15**. In this arrangement, when the rods **311** of the air cylinders **310** move forward, the lower loader **220** inclines and is positioned at the plate feed position where its upper end is close to the lower plate cylinder **6**B, as indicated by a solid line in FIG. **11**. When the rods **311** of the air cylinders **310** move backward, the lower loader **220** is set in the vertical state, as indicated by an alternate long and short dashed line, and is positioned at the wait position.

<Plate Changing Operation of Lower Plate Cylinder>

First, the lower loader **220** is positioned at the wait position, as shown in FIG. **10**A. More specifically, at the retreat position indicated by an alternate long and two short dashed line in FIG. **1**, when the air cylinder **226** (FIG. **2**) is actuated, the lower loader **220** moves in the direction of the arrow A from the position indicated by the alternate long and two short dashed line in FIG. **1**, and is positioned at the wait position close to the printing unit **1** and indicated by the solid line.

In the upper loader **220** located at the wait position, the bent portion of the leading edge **11***a* of the new plate **11** is caught by the guide bar **296**, as shown in FIG. **2**, and the new plate **11** is moved in the direction of an arrow D so that it is inserted in the upper loader **220** from the elongated hole **263** of the inner frame **261**. Subsequently, the bent portion of the leading edge **11***a* of the new plate **11** is transferred from the guide bar **296** to the bars **295** (FIG. **15**), so that the new plate **11** is supported by the bars **295** by its weight.

Subsequently, the rods **311** of the air cylinders **310** move forward, and accordingly the lower loader **220** inclines and is positioned at the plate feed position, as shown in FIG. **11**. Subsequently, the upper and lower blanket cylinders **7**A and **7**B are disengaged from each other, and the driver of the printing press is driven. As shown in FIG. **10**B, the upper and lower plate cylinders **6**A and **6**B are rotated through almost one turn in the forward direction, to disconnect the clutch (not shown) between the driving mechanism of the printing unit **2** and the driving mechanism of the folding machine (not shown). At this time, the web **15** located between the printing unit **1** and the folding machine slacks by an amount substantially corresponding to the length of the circumference of the upper plate cylinder **6**A. An air cylinder (not shown) is actuated to move the dancer roller **16** downward, thus removing the slack.

Subsequently, the rods of the air cylinders **290** move forward, so that the plate removal/feed switching guide board **293** moves in a direction of an arrow G, to be positioned at the plate removal position, as shown in FIG.

16. Then, an air cylinder (not shown) is actuated to bring the plate holding roller **298** into contact opposite to the outer surface of the lower plate cylinder **6**B.

In this state, the reel rod of the plate gripper BB pivots, and the trailing edge **10***b* of the old plate **10** disengages from the lower plate cylinder **6**B and pops up from the outer surface of the lower plate cylinder **6**B. As shown in FIG. **10**B, when the lower plate cylinder **6**B rotates in the opposite direction (counterclockwise in FIG. **10**B), the trailing edge **10***b* of the old plate **10** passes between the plate removal/feed switching guide board **293** and removed plate guide **297**, and is guided to between the removed plate guide board **231** and removal preventive members **232**, as shown in FIG. **11**.

In this manner, since the removed plate guide board **297** for guiding the old plate **10** removed from the lower plate cylinder **6**B and the plate removal/feed switching guide board **293** are provided to the distal end of the lower loader **220** which comes into contact opposite to the outer surface of the lower plate cylinder **6**B, the old plate **10** can be reliably guided to the lower removed plate recovery section **230** through the lower loader **220**.

Subsequently, when the lower plate cylinder **6**B rotates in the opposite direction, the trailing edge **10***b* of the old plate **10** passes the hook **247**, as shown in FIG. **12**.

Subsequently, the plate press roller **298** separates from the outer surface of the plate cylinder **6**B, as shown in FIG. **16**. Also, the rods of the air cylinders **280** move forward, so that the fulcrum rollers **283** are moved in the direction of an arrow H, to press the leading edge **10***a* of the old plate **10** removed from the lower plate cylinder **6**B toward the lower plate cylinder **6**B. The rods of the air cylinders **270** then move forward, so that the swing end **275***a* of the second old plate extracting member **275** moves in the direction of an arrow I, to extract the leading edge **10***a* of the old plate **10** from the plate gripper **8**B of the lower plate cylinder **6**B. The rod of the air cylinder **243** moves forward, and accordingly the hook **247** engages with the bent portion of the trailing edge **10***b* of the old plate **10**. When the hook **247** moves, the old plate **10** is pulled forcibly.

In this manner, the leading edge **10***a* of the old plate **10** pressed by the fulcrum rollers **283** is extracted from the plate gripper **8**B of the lower plate cylinder **6**B by the second old plate extracting member **275**, and after that the trailing edge **10***b* of the old plate **10** is pulled up by the hook **247**. Therefore, the old plate **10** can be removed from the lower plate cylinder **6**B reliably. The removed old plate **10** is recovered and held in the lower removed plate recovery section **230** on the frames **3** and **4** side. In this manner, the old plate **10** recovered in the lower removed plate recovery section **230** is removed from it by the operator when the next plate feed operation is ended.

<Plate Feed Operation>

Upon actuation of an air cylinder (not shown), the plate holding roller **298** comes into contact opposite to the outer surface of the lower plate cylinder **6**B, as shown in FIG. **17**. Subsequently, the rods of the air cylinders **290** move backward, so that the plate removal/feed switching guide board **293** moves in the direction of an arrow J, and is positioned at the plate feed position. Subsequently, the new plate **11** inserted from the elongated hole **263** is positioned between the two regulating members **264** and **265**, and the leading edge **11***a* of the new plate **11** moves in the direction of the arrow J, as shown in FIG. **17**, and is positioned to correspond to the plate gripper **8**B of the lower plate cylinder **6**B.

Simultaneously, the air cylinder **266** is driven to move the second regulating member **265** in the direction of the arrow D (toward the first regulating member **264**), so that the two regulating members **264** and **265** position the new plate **11** in the widthwise direction. In this manner, since a mechanism for positioning the new plate **11** before being mounted on the lower plate cylinder **6**B is provided in the lower loader **220**, no guide unit for guiding the new plate **11** to between the lower loader **220** and lower plate cylinder **6**B need be provided, unlike in the prior art. As a result, the apparatus can be downsized, and the plate size increase can be coped with.

As shown in FIG. **18**, the movable elements **302** of the air cylinders **300** move in the direction of the arrow K, and the pressing portions **304***a* also move in the direction of the arrow K. At this time, the pressing portions **304***a* abut against the trailing edge **11***b* of the new plate **11**, to move the new plate **11** toward the lower plate cylinder **6**B.

Thus, as shown in FIG. **17**, the leading edge **11***a* of the new plate **11** is guided to the outer surface of the lower plate cylinder **6**B by the plate removal/feed switching guide board **293**. When the lower plate cylinder **6**B rotates in the forward direction (clockwise in FIG. **10**C) as shown in FIG. **10**C, the leading edge **11***a* of the new plate **11** abutting against the plate press roller **298** is inserted in the plate gripper **8**B by the plate press roller **298**, as shown in FIG. **17**.

When the lower plate cylinder **6**B rotates substantially through one turn, the trailing edge **11***b* of the new plate **11** is inserted in the plate gripper **8**B by the plate press roller **298**, and after that the reel rod of the plate gripper **8**B pivots to mount the new plate **11** on the outer surface of the lower plate cylinder **6**B.

In this state shown in FIG. **10**D wherein mounting of the new plate **11** is ended, the rods **311** of the air cylinders **310** (FIG. **11**) move backward, so that the lower loader **220** is set in the vertical state and positioned at the wait position (alternate long and two short dashed line). Subsequently, the air cylinder **226** (FIG. **2**) is actuated to separate the lower loader **220** from the printing unit **1** and to position it at the retreat position (position indicated by an alternate long and two short dashed line in FIG. **1**). After that, the clutch between the driving mechanism of the printing unit **2** and the driving mechanism of the folding machine is connected, as shown in FIG. **10**E, to drive the driver of the printing press. Subsequently, the dancer roller **16** moves upward, and then the operator pulls the old plate **10** recovered in the removed plate recovery section **210** in the direction of the arrow B, to extract it to the work space **221**.

In this manner, since the old plate **10** is recovered in the lower removed plate recovery section **230** provided to the frames **3** and **4**, no unit for recovering the old plate **10** need be provided in the lower loader **220**, and the lower loader **220** can be downsized in the sheet convey direction (direction of the arrows A–B). Since the lower loader **220** can move to the retreat position, the work space of the lower removed plate recovery section **230** fixed to the frames **3** and **4** becomes large, and accordingly the old plate **10** can be removed from the lower removed plate recovery section **230** easily.

Since the lower loader **220** itself can be downsized and made lightweight, the air cylinders **310** and **226** for swinging and moving the lower loader **220** can be downsized, so that the apparatus can be downsized.

In this embodiment, a printing press for printing on the web **15** has been described. The present invention can also be applied to a sheet-fed rotary printing press for printing on a sheet.

As has been described above, according to the present invention, since a mechanism for positioning a new plate

before being fed is provided in the loader, no guide unit for a new plate need be provided between the loader and the plate cylinder. Thus, the apparatus can be downsized, and the plate size increase can be coped with.

What is claimed is:

1. A plate inserting apparatus comprising:

a loader for holding a new plate inserted in a lateral direction and feeding the new plate to a plate cylinder;

a first regulating member for regulating a position of one side edge of the new plate inserted in said loader;

a second regulating member for regulating a position of the other side edge of the new plate inserted in said loader, thus positioning the new plate in a widthwise direction in cooperation with said first regulating member; and

first moving means for moving the new plate inserted in said loader in a direction substantially perpendicular to a plate surface, thus accommodating the new plate between said first and second regulating members.

2. An apparatus according to claim **1**, wherein said second regulating member is supported in said loader to be movable in a direction to come close to and separate from said first regulating member.

3. An apparatus according to claim **2**, further comprising second moving means for moving said second regulating member toward said first regulating member.

4. An apparatus according to claim **1**, further comprising a bar which extends in an inserting direction of the new plate and engages with a bent portion at one end of the new plate inserted in said loader.

5. An apparatus according to claim **4**, wherein the new plate supported by said bar is moved by said first moving means as said bar moves.

6. An apparatus according to claim **4**, wherein the new plate supported by said bar is moved by said first moving means about said bar as a swing center.

7. An apparatus according to claim **6**, wherein

said apparatus further comprises a plate removal/feed switching guide which is supported at a distal end of said loader and which is switched between plate removal operation and plate feeding operation, and said bar is supported by said plate removal/feed switching guide.

8. An apparatus according to claim **4**, further comprising a guide bar provided outside said loader to guide the bent portion of one end of the new plate to said bar.

9. An apparatus according to claim **8**, wherein said guide bar is arranged above said bar.

10. An apparatus according to claim **8**, further comprising disengaging means for moving said bar in a direction to come close to said plate cylinder, thus disengaging said bar and the new plate accommodated in said plate accommodating section from each other.

11. An apparatus according to claim **1**, wherein said first moving means comprises a new plate moving member for abutting against the plate surface of the new plate, thus moving the new plate.

12. An apparatus according to claim **11**, wherein

said new plate moving member comprises

a support plate supported to be swingable, and

a plurality of rollers supported by said support plate to touch the plate surface of the new plate, and

said first moving means comprises a driving unit for swinging said support plate.

13. An apparatus according to claim **1**, wherein said second regulating member has a tapered surface on an inner side thereof against which the other side edge of the new plate abuts.

14. An apparatus according to claim **1**, wherein

said loader has a slit in a side surface thereof for allowing insertion of the new plate, and

said second regulating member is provided at such a position not regulating insertion of the new plate into said loader.

15. An apparatus according to claim **14**, wherein said second regulating member is formed smaller than said first regulating member by an amount corresponding to a width of the slit in a direction toward the plate surface of the new plate.

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